SIEMENS

LEVEL METER

0.2 to 1620 kc/s · Type D 344 a1a, a2a, a3a

Full Information

Rel gesamt 3 D 344 a1a, 2a, 3a En · Issue October 1966

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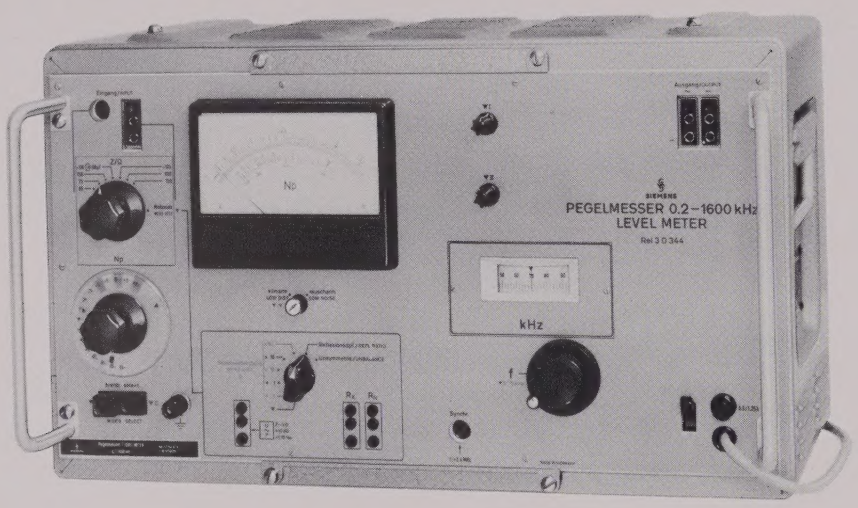

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FIG. 1 LEVEL METER Type Rel 3 D 344a1a

I. APPLICATION

This level meter, designed for wideband and selective measurements, was developed to cover all multichannel carrier telephony systems and their related units of equipment operating in the frequency range from 0.2 to 1620 kc/s. The CCITT basic groups (12 to 108 kc/s), the basic supergroups (312 to 552 kc/s) the supergroups 1 to 6 (60 to 1548 kc/s), and the VF band of telephone channels (300 to 3400 c/s) also fall into the measuring range of this meter.

When the level oscillator Type Rel 3 W 221 is used in conjunction with this device, measurements can also be carried out on impedances, reflection ratios, and common-mode suppression in addition to levels, attenuation,

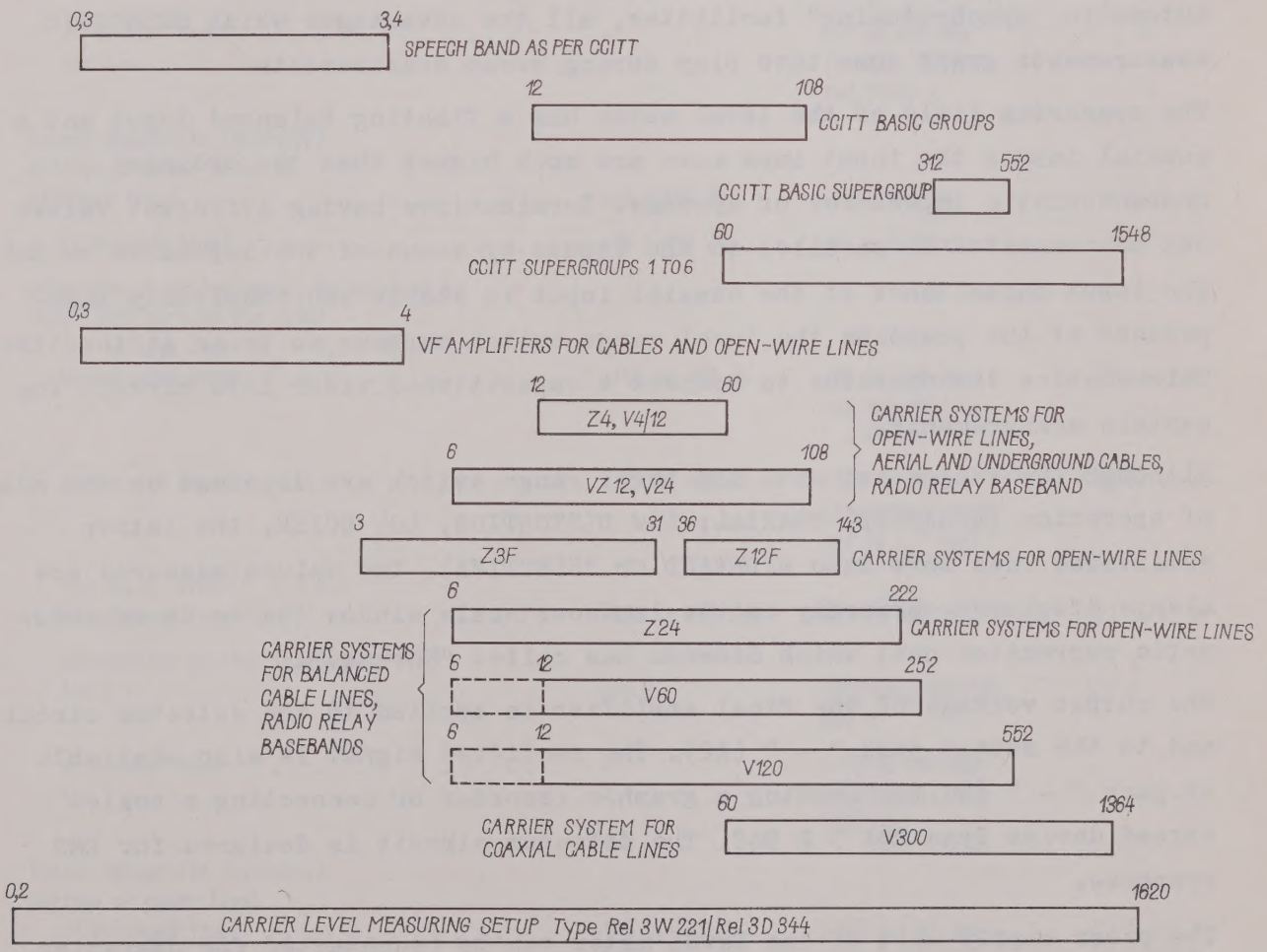


FIG.2 FREQUENCY BANDS COVERED BY THE LEVEL METER

and signal-to-distortion ratios, and no additional equipment is required for these measurements.

The level meter can be switched either to WIDEBAND or SELECTIVE measurements simply by depressing keys. When the meter is switched to SELECTIVE, the heterodyning section with its threefold frequency conversion is interposed between the wideband preamplifier and the final amplifier; a low-pass filter in front of the first modulator wards off the ingress of image frequencies.

During SELECTIVE measurements, the operator can tune the level meter automatically in synchronism with the level oscillator Type Rel 3 W 221 by operating the controls on the latter. However, to do this, both devices must be set up at the same measuring site. If this prerequisite is fulfilled, the oscillator unit G1 of the level oscillator supplies the control voltage for the first modulator of the level meter, whereas the continuously variable oscillator unit G1 of the level meter is inactivated. Thanks to these automatic "synchrotuning" facilities, all the advantages which SELECTIVE measurements grant come into play during sweep measurements.

The measuring field of the level meter has a floating balanced input and a coaxial input; the input impedances are much higher than the ordinary characteristic impedances of systems. Terminations having different values can be connected in parallel to the inputs by means of the impedance switch. The input capacitance of the coaxial input is stable and completely independent of the position the level range switch happens to be in at the time. This enables the operator to connect a capacitive divider into circuit for certain measurements.

Although the ranges set with the level range switch are depedent on the mode of operation (BALANCED, COAXIAL; LOW DISTORTION, LOW NOISE, the latter subdivided once more into WIDEBAND or SELECTIVE), the values measured are always displayed correctly in the luminous scale window thanks to an automatic correction unit which Siemens has called "Koramat".

The output voltage of the final amplifier is applied to the detector circuit and to the output jack " ~ " (AC). The rectified signal is also available at jack " - " (DC for feeding a graphic recorder or connecting a scale-spread device Type Rel 3 B 942. The detector circuit is designed for RMS response.

The power supply unit of the level meter can be reconnected for operation from the customary AC mains. The operating voltages are regulated to the extent required.

II. ELECTRICAL DATA

Frequency range, wideband . . . . . 200 c/s to 1620 kc/s

Frequency range, selective . . . . . 2 kc/s to 1620 kc/s

Level ranges	Model a2a	a3a	a1a
wideband measuring range, as referred to the 0-db (0-N) mark on the meter			
for voltage level (E_0 = 0.775 v)			
at balanced input	-40 to +20 db	-30 to +20 db (as referred to Z = 600 Ω)	-5 to +2 N
at coaxial input	-60 to +20 db	-60 to +10 db (impedance switch set to > 1 meg)	-7 to +2 N
for power level (P_0 = 1 mw)			
at balanced input	-40 to +20 dbm	-30 to +20 dbm	-5 to +2 N
termination or high impedance for Z =	600 Ω	135(125)+, 140 (150), 600 Ω	600 Ω
at coaxial input	-	-50 to +20 dbm	-
for Z =	-	75, 135 (125), 140 (150) Ω	-
lowest measurable (readable) voltage or power level at balanced input	-50 (-65) db	-40 (-55) dbm	-6 (-8) N
at coaxial input	-70 (-85) db	-60 (-75) dbm	-8(-10) N
selective measuring range, as referred to 0-db (0-N) mark on the meter			
for voltage level (E_0 = 0.775 v)			
at balanced input	-100 to +20 db	-90 to +20 db (as referred to Z = 600 Ω)	-11 to +2 N
at coaxial input	-120 to +20 db	-120 to +10 db (impedance switch set to > 1 meg)	-13 to +2 N
for power level (P_0 = 1 mw)			
at balanced input	-100 to +20 dbm	-90 to +20 dbm	-11 to +2 N
termination or high impedance for Z =	600 Ω	135(125),140(150), 600 Ω	600 Ω
at coaxial input	-	-110 to +20 dbm	-
for Z =	-	75,135(125),140 (150) Ω	-
lowest measurable (readable) voltage or power level			
at balanced input	-110 (-125) db	-100 (-115) dbm	-12 (-14) N
at coaxial input	-130 (-145) db	-120 (-135) dbm	-14 (-16) N

+ The impedance values in parentheses can be chosen in place of the preceding values. (Refer to Instructions for Use, p.3.6.)

Level error at 100 kc/s
for 0-db (0-N) mark
in position 0 db (0 N)
of range switch . . . . . ±0.2 db (±0.02 N)

additional error for
other positions . . . . . ±0.2 db (±0.02 N)

in the positions -120 db,
-110 dbm, and -13 N . . . . . ±0.4 db (±0.04 N)

Frequency response of the indication
as referred to 100 kc/s . . . . . ±0.2 db (±0.02 N)

Variation of the indication when
mains voltage deviates by ±10% . . . . . ±0.2 db (±0.02 N)

Selective measurements
pass-band width
(attenuation increase
a ≤ 0.5 db (≤ 0.05 N)) . . . . . f_m ±30 c/s

stop-band attenuation
at f_m ±400 c/s . . . . . ≥ 50 db (≥ 6 N)

image frequency rejection:

f_{sp1} (f_m +4.8 mc/s) . . . . . ≥ 60 db (≥ 7 N)
f_{sp2} (f_m +144 kc/s) . . . . . ≥ 80 db (≥ 9 N)
f_{sp3} (f_m +4 kc/s) . . . . . ≥ 80 db (≥ 9 N)

attenuation of the first
intermediate frequency . . . . . ≥ 80 db (≥ 9 N)

residual distortion ratio a_{k2}, a_{k3}
with a sensitivity increase of
60 db (7 N) . . . . . ≥ 80 db (≥ 9 N)

Impedance of the balanced input

from 1 to 500 kc/s . . . . . ≥ 10 kΩ
from 0.3 to 1000 kc/s . . . . . ≥ 5 kΩ
from 0.2 to 1620 kc/s . . . . . ≥ 3 kΩ

	Model a2a	a3a	a1a
can be switched to	140(135), 150, 600 Ω	135(125), 140(150), 600 Ω	150, 600 Ω

Common-mode suppression up to 600 kc/s . . . . . ≥ 50 db (≥ 6 N)

Impedance of the coaxial input
from 0.2 to 1620 kc/s . . . . . ≥ 1 meg ‖ $\frac{1}{\omega C_e}$

residual capacitance C_e (constant) . . . . . 60 pf

can be switched to	65, 75, 150 Ω	75, 135 (125), 140 (150) Ω	65, 75 150 Ω

	Model a2a	a3a	a1a
Output level at jack OUTPUT ~ (AC) with 0-db (0-N) indication; $Z \rightarrow \infty$, Z_i = 600 Ω	0 db	0 db	0 N
Voltage and current at jack OUTPUT ⎓ (DC) with 0-db (0-N) indication			
current between wires a and b with 2.5-kΩ termination	77.5 µa	77.5 µa	77.5 µa
voltage between wires a and c (blank plug in b-wire jack) with 30-kΩ termination	2.325 v	2.325 v	2.325 v

Impedance Measurements

Five impedance ranges (as referred to full-scale deflection) . . . . . 10, 30, 100, 300 Ω; 1 kΩ

maximum measurable impedance . . . . . 5 kΩ

Impedance error, as referred to full-scale deflection . . . . . ≤ 10%

Measurements of Matching and Balance-to-Unbalance Ratio (Common-Mode Suppression)

Measuring range . . . . . up to 40 db (4.6 N)

Measuring error

for R_X and R_N between 60 and 1200 Ω . . . . . ≤ 1 db (≤ 0.1 N)

Power Supply . . . . . 110; 130; 220 (230); 240 v; 47 to 63 c/s; approx. 60 va

III. FUNCTIONING AND LAYOUT

Level Meter Type Rel 3 D 344

1. General

As the block circuit diagram (Fig. 3) indicates, the voltage under test is amplified in a preamplifier and a final amplifier when wideband measurements are to be carried out; from there it is applied to the output jack "~ " (AC) and to the detector circuit with its instrument J and output jack " - " (DC). In the case of selective measurements, the voltage under test is translated to an intermediate frequency (2 kc/s) within the audio range in there frequency-converting stages provided by an interposed heterodyning section. The preceding measuring field contains the various input circuits, impedance and level range switches used during operation.

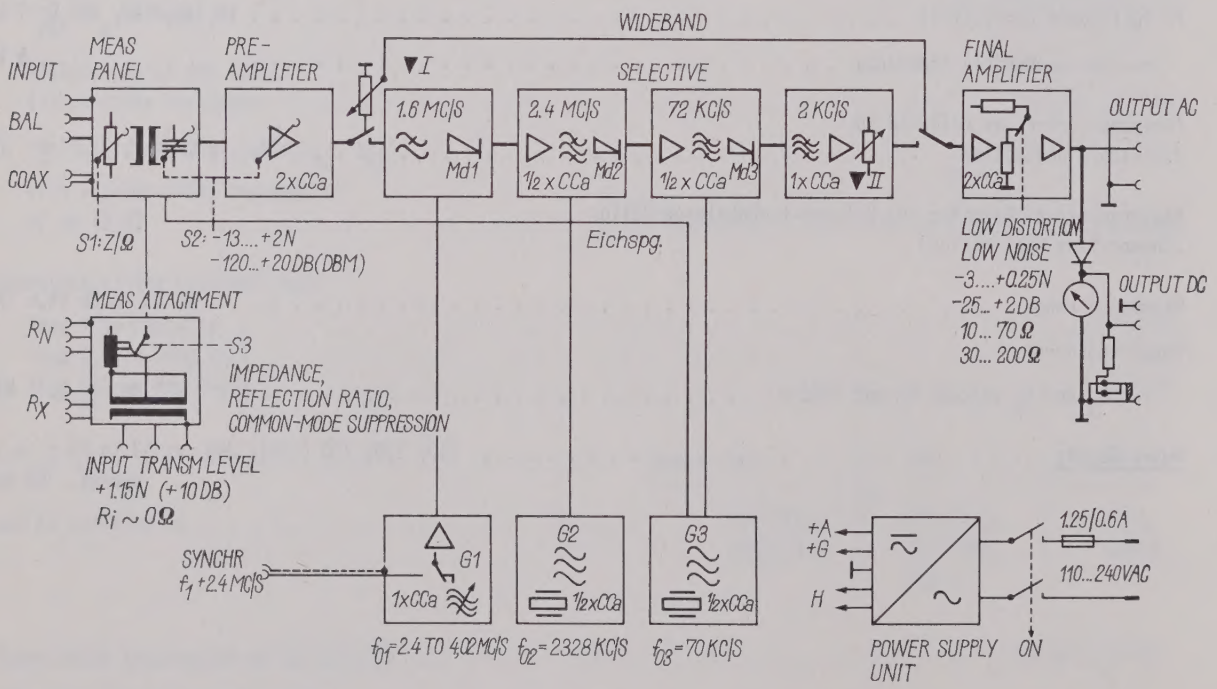


FIG.3 BLOCK DIAGRAM OF THE LEVEL METER

2. Measuring Field and Preamplifier (Fig. 4)

The measuring field has a blanced and a coaxial input. With the impedance switch S1 these inputs can either be terminated into various ohmic values[+] or set to high impedance (> 10 kΩ balanced and > 1 meg ‖ 60 pf coaxial).

When the connection is coaxial, the measuring voltage reaches the input divider directly; when it is balanced, the measuring voltage is applied via a wideband transformer with a transformation ratio of 10:1(20 db) (on the neper model, the transformation ratio ü = 7.39:1 (2 N)). For this reason the sensitivity is always 20 db (2 N) lower when balanced measurements are carried out.

On the model for power level measurements, a resistive divider is switched into circuit before the first capacitive divider (30-db attenuation) in such a way that it increases the pertinent correction $10_{\log \frac{600\ \Omega}{Z}}$ by 10 db. When the input level is 0 dbm for all switchable impedance values of the balanced input, a voltage level of -30 db results at the output of this resistive divider; for the switchable impedance values of the coaxial input this level is -10 db. When Z > 1 meg ‖ 60 pf (coaxial), this correction divider is bypassed. When the impedance switch S1 is in this position, the sensitivity of the level meter is 30 db greater than when the balanced input is used: the meter indicates the voltage level (E_o = 0.775 v).

The input capacitance C_e = 60 pf of the coaxial input remains constant throughout all the positions of the level range switch S2. In exceptional cases the effective capacitance can be reduced by using a capacitive divider designed as a probe.

The stepwise adaptation of the level meter to the voltage under test is effected not only at the input, but also at different other points along the signal path. Distributing the sensitivity adaptation in this way has the advantage that optimum signal conditions with respect to noise, residual distortion and possible intermodulation are assured at every stage irrespective of the mode of measuring adopted (WIDEBAND, SELECTIVE, LOW DISTORTION, LOW NOISE). Fig.4 is a simplified presentation of the layout of the input divider and the preamplifier. On the basis of this illustration, the course of the control circuit action, direct or indirect, can easily be traced for the level range set with switch S2.

[+] the ohmic values depend on the meter model used: refer to Electrical Data, p. 1.3

Two capacitive dividers precede the preamplifier. The first one, with an attenuation of 30 db, is controlled via switch deck $S2^{II}$ and relay A; the second divider, with an attenuation of 40 db, is between decks $S2^{IV}$ and $S2^{V}$ and is directly activated when the level range switch is in positions 4 and 5.

By varying the degenerative coupling via the deck $S2^{VI}$, the gain of the preamplifier can furthermore be set to 40, 30, 20 and 10 db (on the neper model: 3.7, 2.7, 1.7 and 0.7 N). A variable, resistive 20-db network is applied to the output of the preamplifier via the relay B.

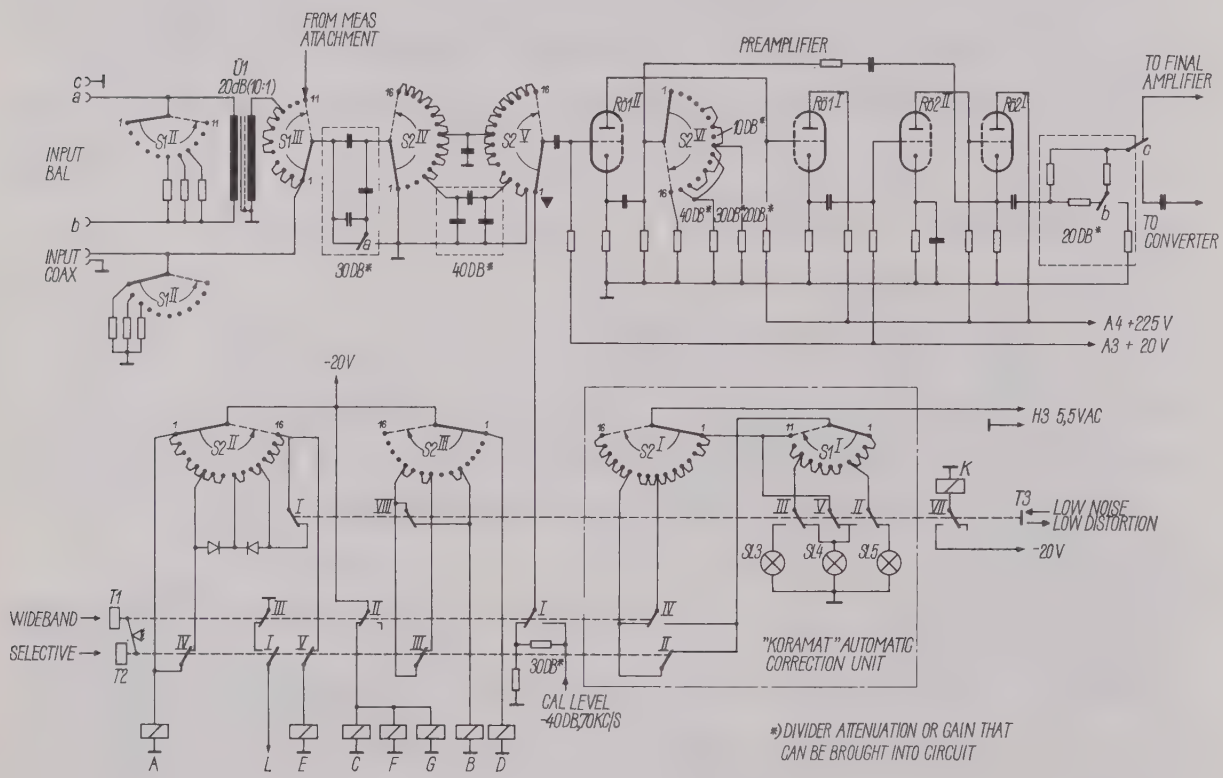


FIG.4 SIMPLIFIED CIRCUIT DIAGRAM OF THE MEASURING FIELD AND THE PREAMPLIFIER

The gain of the heterodyning section can be varied by 20 db by operating switch S2 to certain positions and thus switching the inductive divider L14 via a contact of relay E (Fig. 7).

The turnbutton LOW DISTORTION, LOW NOISE (T3) in the measuring field controls a resistive 20-db divider in the final amplifier between tubes 6 and 7 via relay K. The sensitivity of the final amplifier is decreased by 20 db when the turnbutton is operated to LOW NOISE. When full-scale deflection is desired on the instrument, the input level must be 20 db higher than it is when the turnbutton is in the position LOW DISTORTION. As a result, the ratio of the measuring level to the residual noise of the level meter, in other words the signal-to-noise ratio, is improved by 20 db.

When the switch is in the position CALIBRATING, relay D applies the calibrating voltage from oscillator unit G3 (70 kc/s) to the measuring field. In the setting CALIBRATING WIDEBAND the calibrating voltage is applied directly to the preamplifier, in the setting CALIBRATING SELECTIVE only via a 30-db divider. Relays C and F are controlled by the pushbuttons T1 WIDEBAND and T2 SELECTIVE; when the WIDEBAND button is depressed, the preamplifier and the final amplifier are cascaded; when the SELECTIVE button is depressed, the heterodyne unit is interposed between them.

The level range switch S2 is equipped with an automatic correction unit ("Koramat") which eliminates the correction factors arising while the level range is being read due to the various sensitivity settings at the input (the level range switch remaining in the same setting). Thus, operation is greatly simplified and this common source of measuring faults is obviated.

The level range for all the measurements that can be carried out with this meter (balanced or unbalanced input, low distortion and low-noise measurements) is indicated on a translucent, calibrated scale in a luminous window (Fig. 5). The automatic correction unit also indicates the fact that the level range limits have been exceeded (which may happen during wideband measurements) by keeping all the windows dark.

The difference between each of the three input sensitivities which result is 20 db, which value corresponds to two detent positions of the level range switch S2. The spacing of the three lamps SL3, 4, and 5 in the luminous panel of the automatic correction unit is the same (see Fig.5). The lamps are switched on individually via the switches $S2^{I}$ and $S1^{I}$, the pushbuttons $T1^{IV}$ and $T2^{II}$, and the turnbuttons $T3^{II}$, $T3^{III}$, and $T3^{V}$.

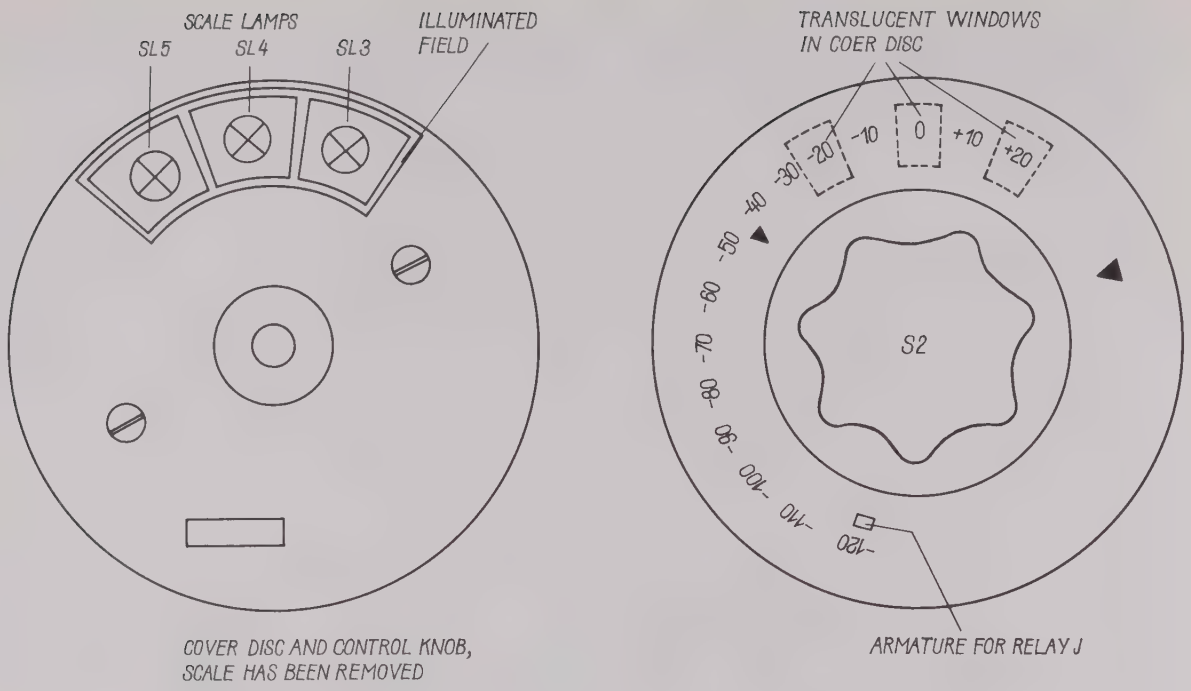


FIG.5 LAYOUT OF THE AUTOMATIC CORRECTION UNIT

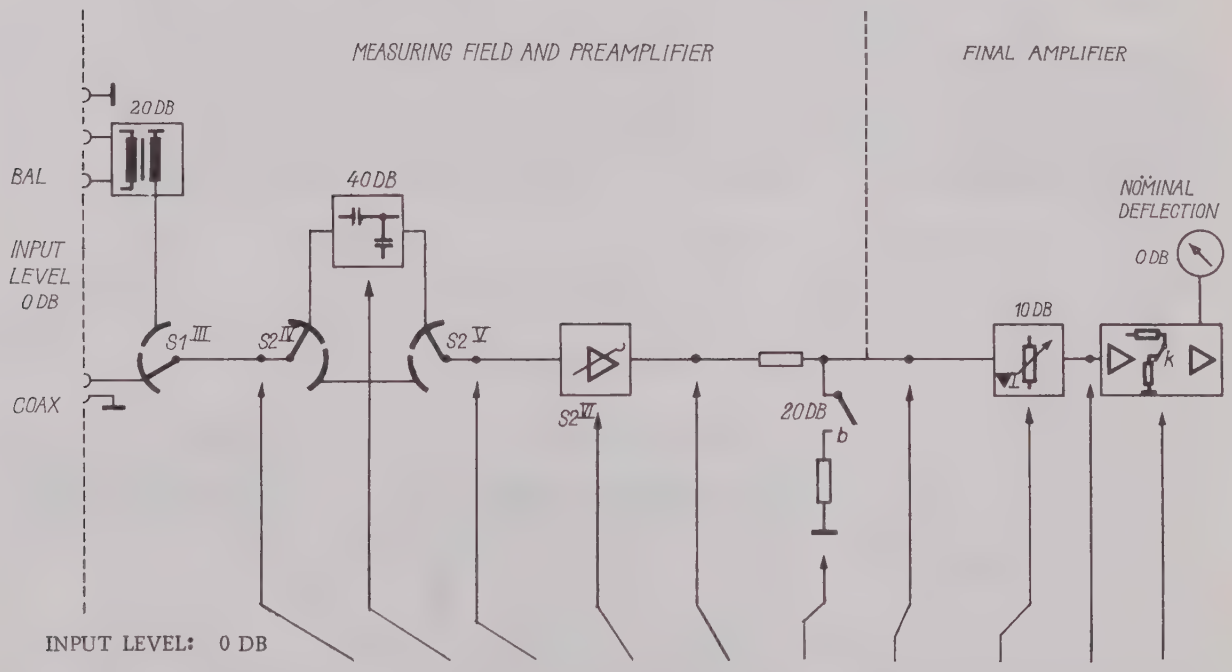
The high-impedance coaxial input of the level meter with which power may be measured (model a3a) is 10 db more sensitive than the terminated coaxial ranges. The required correction is afforded by an additional relay, namely relay J, which rotates the windows in the KORAMAT's cover disc one step to the left so that the measuring range which is 10 db more sensitive is also indicated without requiring the switch to be operated.

The result of the measurement is found by adding the value indicated on the Koramat to the level read from the instrument.

The preamplifier (Rö1, 2) is a highly linear wideband amplifier of low residual distortion. Its four triode sections are alternately connected as grounded-cathode amplifiers and cathode followers. To avoid coupling capacitances and thus phase shifts at low frequencies, the grids of the second and the fourth tube section are at the anode potential of the preceding tube section. From the cathode of the fourth stage a degenerative path goes to the cathode of the first stage. The gain may be switched by reconnecting the dividing ratio of this voltage degeneration.

The individual levels resulting along the signal path may be drawn from the following two tables (Figs. 6 and 7). Refer to the section Fault Eliminating for detailed level tables for all models. For one and the same input level, the level range switch S2 may be set to any of three different settings depending upon whether the level is to be applied to the balanced or the coaxial input and whether low-noise or low-distortion measurements are to be carried out. An additional setting may be used in the case of the level meter for power levels (model a3a): when the impedance switch is operated to the high impedance setting the sensitivity at the coaxial input increases by 10 db.

a. Wideband Measurements

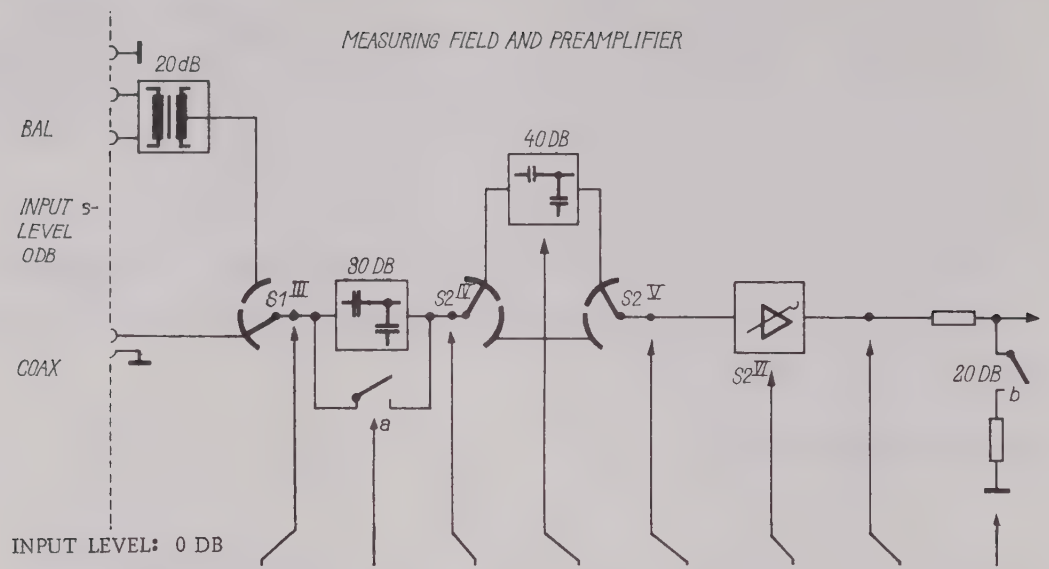


INPUT LEVEL: 0 DB

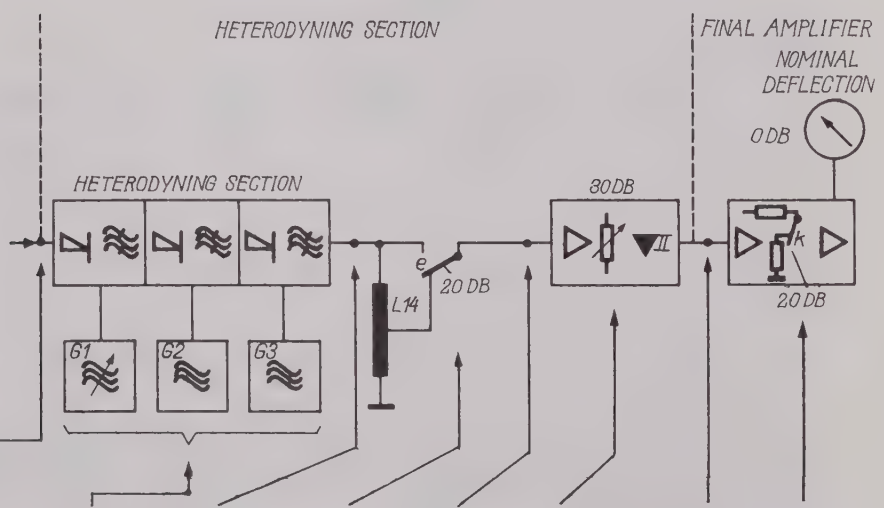
Input	T3 set to	S2 in position	Level in db	Att'n in db	Level in db	Gain in db	Level in db	Att'n in db	Level in db	Att'n in db	Level in db	Att'n in db
bal.	low distor.	6	-20	0	-20	10	-10	20	-30	10	-40	0
bal.	low noise	8	-20	0	-20	10	-10	0	-10	10	-20	20
coax.	low distor.	4	0	40	-40	10	-30	0	-30	10	-40	0
coax.	low noise	6	0	0	0	10	+10	20	-10	10	-20	20

FIG.6 LEVEL TABLE FOR WIDEBAND MEASUREMENTS WITH AN INPUT LEVEL OF 0 DB

b. Selective Measurements



Input	T3 set to	S2 in position	Level in db	Att'n in db	Level in db	Att'n in db	Level in db	Gain in db	Level in db	Att'n in db
bal.	low distor.	6	-20	30	-50	0	-50	10	-40	20
bal.	low noise	8	-20	30	-50	0	-50	10	-40	0
coax.	low distor.	4	0	30	-30	40	-70	10	-60	0
coax.	low noise	6	0	30	-30	0	-30	10	-20	20



Input	T3 set to	Level in db	Gain in db	Level in db	Att'n in db	Level in db	Gain in db	Level in db	Att'n in db
bal.	low distor.	-60	10	-50	20	-70	30	-40	0
bal.	low noise	-40	10	-30	20	-50	30	-20	20
coax.	low distor.	-60	10	-50	20	-70	30	-40	0
coax.	low noise	-40	10	-30	20	-50	30	-20	20

FIG.7 LEVEL TABLE FOR SELECTIVE MEASUREMENTS WITH AN INPUT LEVEL OF 0 DB

3. Heterodyning Section (Figs. 8, 9, 10, 11, and 12)

a. Input Low-Pass Filter, 1st Frequency Conversion (f_m/2.4 mc/s)

For suppressing the response to image frequencies and for blocking intermediate-frequency signals, a low-pass filter with a pass-band width of up to 1.62 mc/s precedes the first modulator Md1. The basic circuit and the attenuation-vs.-frequency curve are depicted in Fig. 9. The variable oscillator unit G1, whose frequency f_{o1} is continuously tunable from 2402 to 4020 kc/s, furnishes the control voltage for modulator Md1.

This oscillator unit is equipped with a double triode CCa. One section operates in a Colpitts circuit as oscillator and the other as buffer stage and amplifier. The mixing product behind the modulator includes the voltage with the first intermediate frequency f_{Z1} = 2.4 mc/s as difference of the oscillator frequency f_{o1} and the measuring frequency f_m = 2 to 1620 kc/s ($f_{Z1} = f_{o1} - f_m$). The scale of G1 is calibrated for f_m.

If the oscillator unit G1 is set to the frequency of 2.4 mc/s (on the frequency scale below the first calibrating mark), this voltage reaches as IF voltage the signal path via the modulator and the level meter reads full-scale deflection. The same applies in the case of automatic tuning by means of the level oscillator if the oscillator supplies a voltage with the frequency of 2.4 mc/s (in zero position on the scale). This does not mean, however, that the device is faulted, since this setting does not belong to the measuring range of the level meter.

For the operation with automatic tuning (Fig.10), connect the jacks SYNCHR of the level oscillator Type Rel 3 W 221 and the level meter by means of a coaxial lead. This connection also closes the DC path for relay H. Via contact h the oscillating stage ($Rö8^{II}$) in the oscillator of the level meter is blocked by a voltage of -20 v and oscillator voltage of the variable transmitting oscillator, transformed with Ü2, is applied to the input of the buffer stage ($Rö8^{I}$). The level meter is thus automatically tuned to the frequency f_1 set on the oscillator.

The output voltage of the frequency f_{Z1} = 2.4 mc/s reaches the grid of a grounded-anode stage (Rö3) via transformer Ü2 tuned to f_{Z1}. The following 2.4-mc/s filter (Fig.11) is connected to this impedance converter stage via the series resistor R19. The filter terminates in the input of the ring modulator Md2.

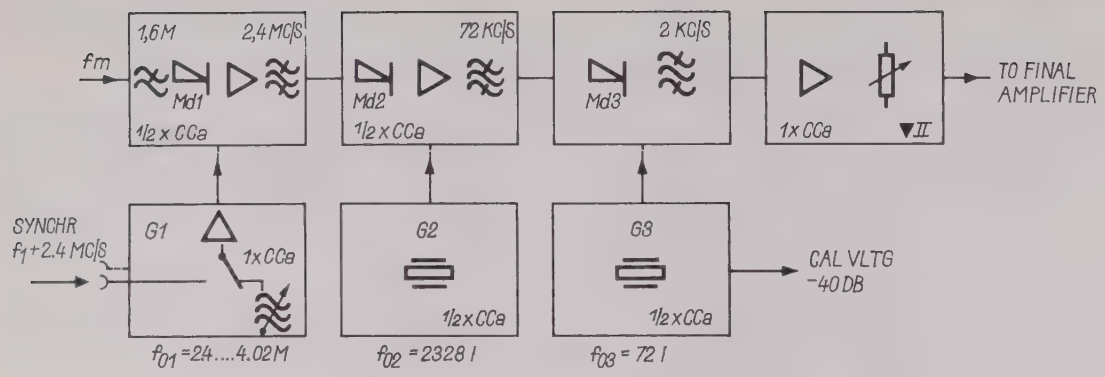


FIG. 8 BASIC CIRCUIT DIAGRAM OF THE HETERODYNING SECTION

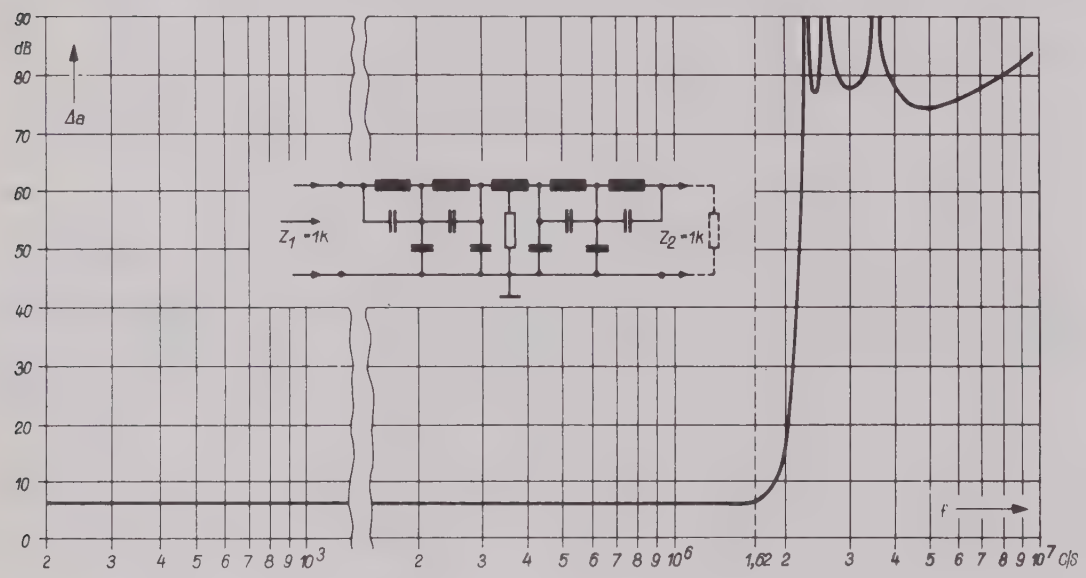


FIG. 9 CIRCUIT DIAGRAM AND ATTENUATION CURVE OF THE 1.62-MC/S LOW-PASS FILTER

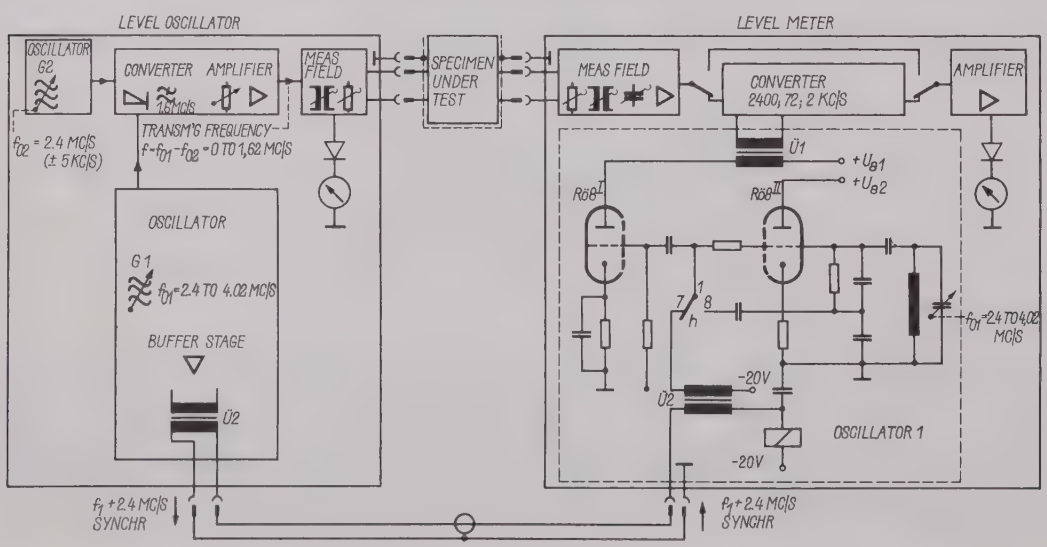


FIG. 10 BASIC CIRCUIT DIAGRAM OF THE MEASURING SETUP FOR OPERATION WITH THE AUTOMATIC TUNING SYSTEM

b. 2nd and 3rd Frequency Conversions (2.4 mc/s/72 kc/s; 72/2 kc/s) (Fig. 8)

The voltage with the first intermediate frequency f_{Z1} is applied to the ring modulator (Md2) as signal voltage via the transformer Ü3 and the voltage of oscillator unit G2 as control **voltage.** The tuned transformer Ü4 and the 72-kc/s filter connected via the impedance converter stage with tube 4 extract from the mixing product the voltage of the second intermediate frequency $f_{Z2} = f_{Z1} - f_{02}$ (2400 kc/s - 2328 kc/s = 72 kc/s). The oscillator frequency of f_{02} = 2328 kc/s is stabilized by means of a crystal, and the amplitude via a Zener diode.

Since a frequency of 2256 kc/s would also result in 72 kc/s in modulator Md2 (image frequency), voltages of this frequency are already attenuated by more than 80 db by an attenuation pole in the preceding 2.4-mc/s filter.

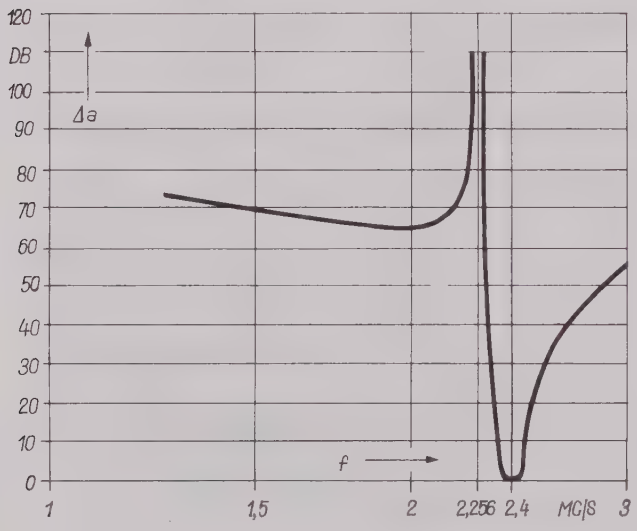


FIG.11 ATTENUATION-VS.-FREQUENCY CURVE OF THE 2.4-MC/S FILTER

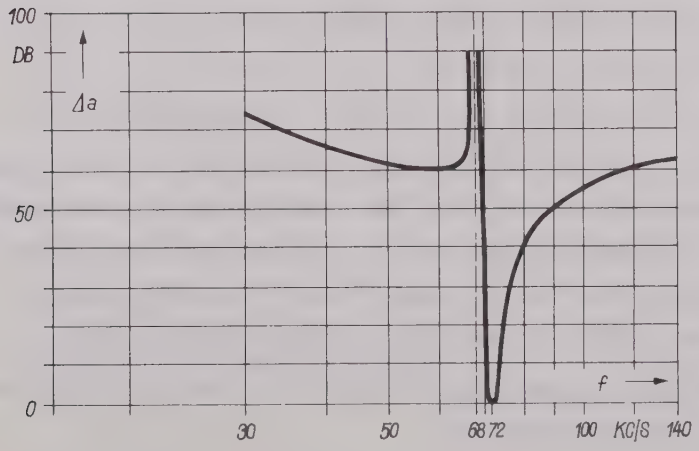


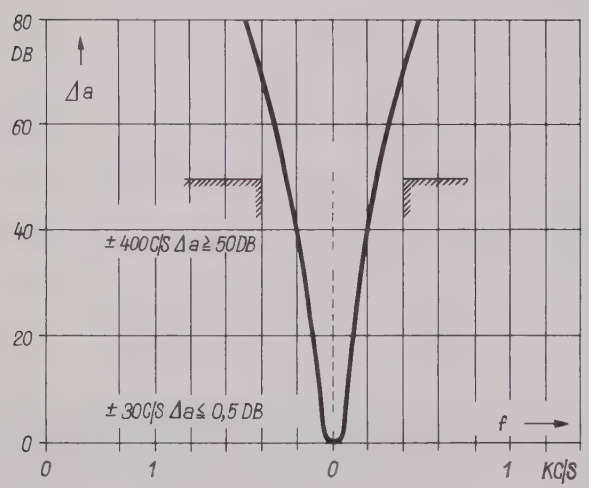
FIG.12 ATTENUATION-VS.-FREQUENCY CURVE OF THE 72-KC/S FILTER

The voltage to be measured is converted to the third intermediate frequency of f_{Z3} = 2 kc/s in the same way, viz. via modulator Md3 and the 2-kc/s band-pass filter. The image frequency of this converter stage is at 68 kc/s; voltages of this frequency are therefore attenuated by more than 80 db by an attenuation pole in the 72-kc/s filter (Fig.12).

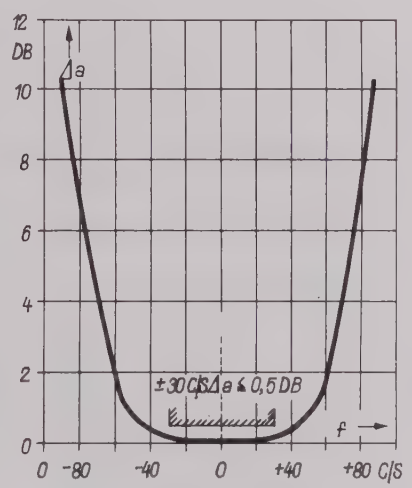
Due to DC degeneration and amplitude stabilization by means of crystal diodes, the crystal oscillator G3 (f_3 = 70 kc/s) furnishes a constant control voltage independent of variations of the mains voltage.

Its amplitude and frequency stability is so high that the oscillator is also used as calibrating voltage source (connection g5,6 to the measuring field).

The 2-kc/s band-pass filter determines the selectivity of the heterodyning section. Its relative attenuation-vs.-frequency curve in the pass-band width of 2 kc/s ± 30 c/s is $\leq$ 0.5 db; from 2 kc/s ± 400 c/s onward its stop-band attenuation is $\geq$ 50 db (Fig. 13).



a. SELECTIVE CURVE, OVERAL CURVE



b. SELECTIVE CURVE, PASS-BAND WIDTH

FIG.13 ATTENUATION-VS.-FREQUENCY CURVE OF THE 2-KC/S BAND-PASS FILTER

The winding of the last filter coil L14 of the 2-kc/s band-pass filter is additionally provided with a tap for a voltage which is 20 db lower. Relay E controlled by the level range switch S2 and the turnbutton T3 connects the following 2-kc/s amplifier either to the top or to the entire winding, depending on the measuring range. The 2-kc/s amplifier (with tube CCa5) supplies the level required for the final amplifier. The potentiometer " . ▼. II", with which the output voltage of the converter section can be adjusted by ±3 db, is arranged at its output.

3. Final Amplifier and Detector Circuit

(see circuit diagram Rel str 3 D 344... in the circuit data folder)

The final amplifier is a four-stage wideband amplifier (CCa, Rö6, 7), two tube sections each establishing a unit with negative feedback. A resistive 20-db divider (R83, 84, 85) is interposed. For the measurement LOW NOISE it is connected by relay K via the turnbutton T3.

The output voltage of the final amplifier reaches the detector circuit including two germanium crystal diodes and the moving-coil instrument J. The ratio between the charging and discharging time constants of the detector circuit is so designed that a quasi-RMS response results.

A resistive circuit with the break jacks OUTPUT DC, via which at nominal deflection on the instrument (0 db) 77.5 µa flows at Ra = 2.5 kΩ, is additionally connected to the detector circuit. A recording device (graphic recorder), a scale-spread device (for instance Type Rel 3 B 942), or a similar device connected to these jacks replaces the (substitution) resistor R10 (2.5 kΩ) in this circuit.

The input resistance of these devices must amount to 2.5 kΩ (as for instance in the case of the scale-spread device Type Rel 3 B 942) or be built out to this value. Devices with a high-impedance input (approx. $\geq$ 300 kΩ) can be connected to the a- and o-wires of this jack; the output voltage between these wires is about 2.3 v when 0 db (0-N) is indicated on the instrument.

The jack OUTPUT ~ AC is connected to the output of the final amplifier via the voltage divider R110, R115. When the instrument indicates 0 db, a level of 0 db (without load) is at this jack, viz. with the frequency f_m in the case of wideband measurement and with the IF frequency f_{Z3} = 2 kc/s in the case of selective measurement. For the IF voltage relay G connects a resonant circuit across the output so that interfering voltages of another frequency, as for instance hum and noise voltages, are once more suppressed.

4. Measuring Attachment

The measuring attachment is an additional facility incorporated in the level meter for measuring impedances, return losses, and balance-to-unbalance ratios.

In the position MEAS ATT'T the impedance switch ($S1^{III}$) of the level meter connects the output of this attachment to the input of the level meter.

The measuring voltage (e.g., that of the level meter Type Rel 3 W 221) is applied to this measuring circuit via the jacks OSCILLATOR. The jacks "R_X" and "R_N" serve for connecting the specimen and the reference standard.

a. Impedance Measurement (Fig. 14)

Via the jack OSCILLATOR, Z ~ 0 Ω, the measuring attachment is fed with a voltage having a level of +10 db/+1 N. By way of the jack "R_X" the specimen is connected in series with a well-defined resistance R which is very small as compared to the magnitude of the impedance. The voltage drop across this resistor is measured by the level meter, showing the current flowing through R_X. At a constant transmitting voltage this current is inversely proportional to the impedance. Its value is indicated by the level meter which has two ohm scales for this measurement. With switch S3 in the measuring attachment the measuring ranges x1, x10, x100 can be set via transformer Ü2.

b. Measuring Return Losses (Signal-to-Reflection Ratios) (Fig. 15)

The specimen R_X and an impedance standard R_N are one branch of the built-in bridge circuit, the other includes the highly balanced secondary winding of the transformer Ü1. The bridge is fed with a level of +10 db via the jack "OSCILLATOR, Z ~ 0 Ω". The circuit is so dimensioned that, at this transmitting level, the return loss is the direct sum of the readings on the level range switch (Koramat) and the instrument, however the algebraic sign is reversed. It corresponds to the expression:

$$a_r = 20 \log_{10} \left| \frac{R_X + R_N}{R_X - R_N} \right| = 20 \log_{10} \left| \frac{1}{r} \right| \text{ in decibels}$$

$$a_r = \log_e \left| \frac{R_X + R_N}{R_X - R_N} \right| = \log_e \left| \frac{1}{r} \right| \text{ in nepers}$$

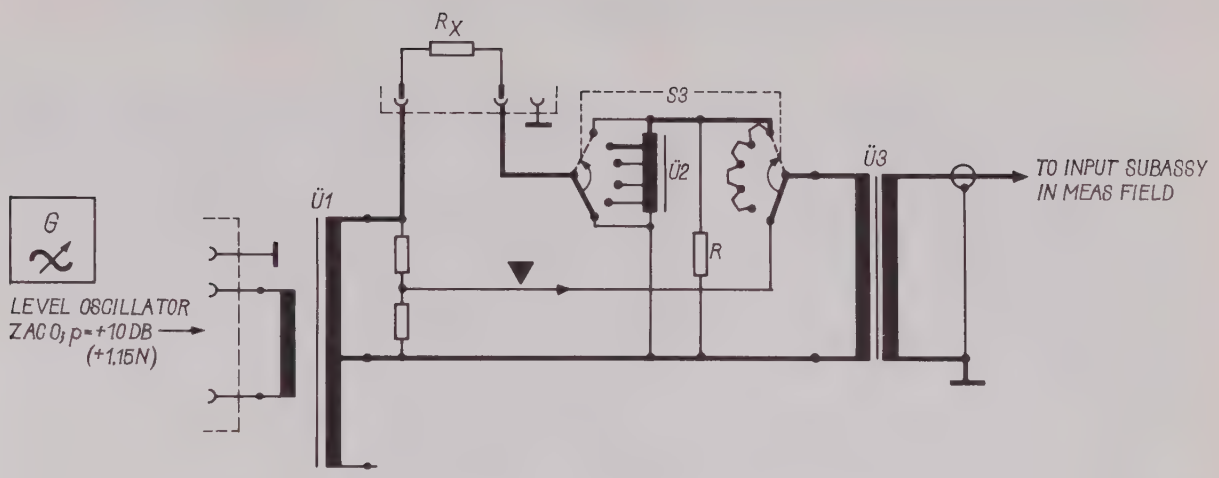


FIG.14 IMPEDANCE MEASUREMENT

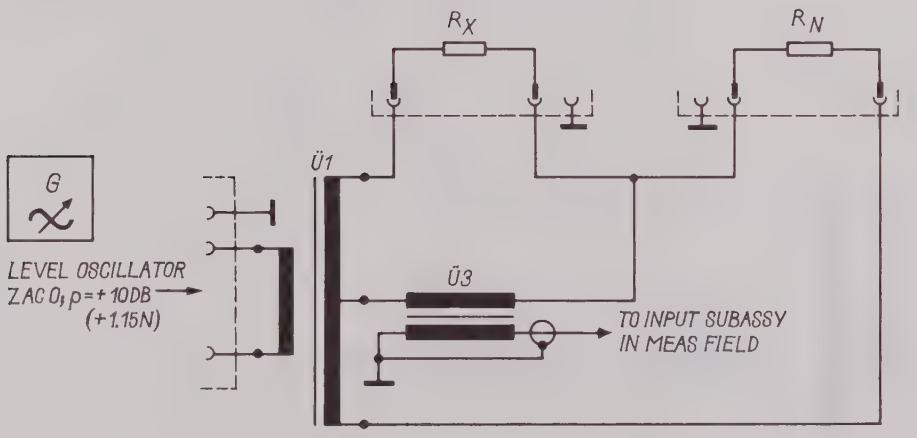


FIG.15 MEASUREMENT OF THE REFLECTION RATIO

c. Measuring Balance-to-Unbalance Ratios (Common-mode Suppression) (Fig. 16)

The partial impedances R_{X1} and R_{X2} of the specimen with respect to ground establish one branch of the bridge circuit, the other includes the highly balanced secondary winding of the transformer Ü1. The bridge is fed via the jack "LEVEL OSCILLATOR, Z~ 0 Ω" (level +10 db). In the same way as the return loss, the common-mode suppression "a_{uns}" is thus found directly from the level measured. It corresponds to the expression:

$$a_{uns} = 20 \log_{10} \left| \frac{R_{X1} + R_{X2}}{R_{X1} - R_{X2}} \right| \quad \text{in decibels}$$

$$a_{uns} = \log_e \left| \frac{R_{X1} + R_{X2}}{R_{X1} - R_{X2}} \right| \quad \text{in nepers}$$

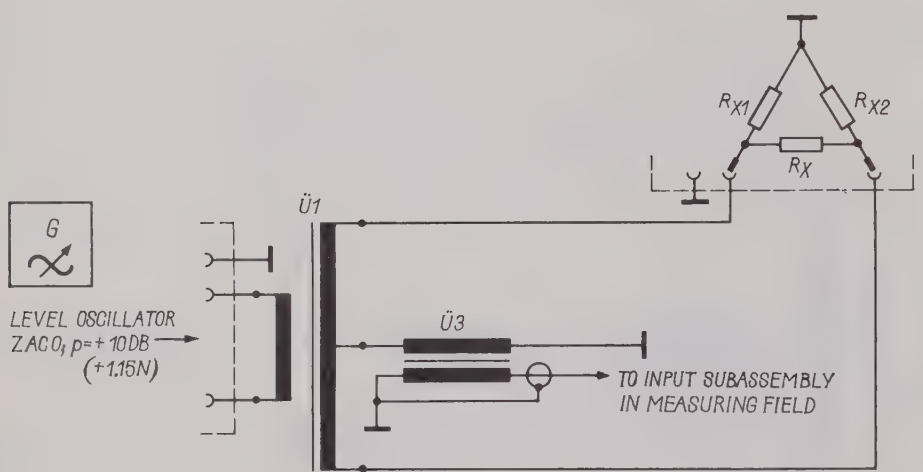


FIG.16 MEASURING COMMON-MODE SUPPRESSION

IV. ATTACHMENTS

Scale-Spread Device Type Rel 3 B 942

This attachment allows the spreading of the partial range of -1 to +1 db (-0.1 to +0.1 N) of the indicating instrument of a level meter to the full scale range of its instrument. Its scale is graduated at intervals of 0,05 db (0.005 N). Level variations down to 0.02 db (0.002 N) can thus still be read. Such a possibility, for instance, is of particular importance in checking the pass band width of filters. Pass-band irregularities which can hardly be noticed on customary level meter scales can be measured rapidly and reliably with this device. The scale-spread device offers decided advantages in serial checks on quadripoles (amplifiers or attenuator networks) by the comparison method. It is independent of the measuring frequency since the measuring voltage is taken from the DC end of the detector circuit (jack "-" on the level meter Type Rel 3 D 344). Closer details are stated in the Instructions for Use Rel gesamt 3 B 942.

V. TYPES, DIMENSIONS, AND WEIGHTS

Description	Type	Dimensions in mm	Approx. weight in kg
Level Meter 200 c/s to 1620 kc/s			
Model -130 to +20 db	Rel 3 D 344a2a	556x326x307	18
Model -120 to +20 dbm	Rel 3 D 344a3a	556x326x307	18
Model -14 to + 2 N	Rel 3 D 344a1a	556x326x307	18
Accessories per Device			
8 tubes	CCa or E88CC	-	-
1 stabilizer tube.	108 C 1	-	-
4 indicating lamps	Fg lp 62 bc	-	-
1 fuse link 0.63 amp for 220/240 v	M 0,63 G DIN 41571 trop	-	-
1 spare parts bag with			
2 fuse links 0.63 amp for 220/240 v	M 0,63 G DIN 41571 trop	-	-
2 fuse links 1.25 amp for 110/130 v . . .	M 1,25 G DIN 41571 trop	-	-
2 indicating lamps	Fg lp 62 bc	-	-
1 lamp extractor	C44121-A9-C1	-	-
1 inner hex wrench	1,5 DIN 911	-	-
Optional			
Connecting cords,			
balanced, shielded	Rel ltg 546a-d	500, to 2000	0.2
balanced, shielded	Rel ltg 703d-h	1000, to 3000	0.2
coaxial	Rel ltg 533b-e	500, to 1500	0.25
1 level oscillator	Rel 3 W 221	556x326x307	17.5
1 sweep attachment	Rel 3 W 935	556x258x307	11.6
1 level tracer	Rel 3 D 346	556x394x512	35
1 scale-spread device	Rel 3 B 977	163x127x90	1.5

Description	Type	Dimensions in mm	Approx. weight in kg
1 reflectometer bridge	Rel 3 R 132	240x170x75	1
1 decade resistor e.g., up to 500 kc/s	Rel 3 B 41	144x247x185	1.5
1 decade capacitor e.g., for up to 500 kc/s . . .	Rel 3 B 51	144x247x185	1.5
1 µa-Multizet recorder 12 k/T .	M-L.No. 258,424	-	19
with			
µa Extra Multizet meter . . .	M-L.No. 258,429	-	0.9

I N S T R U C T I O N S F O R U S E

I. PREPARATION

The devices leave the factory adapted for connection to AC mains of 220 v. Before placing them into operation, check whether the mains voltage has the same value as the set voltage. If the devices are to be operated from mains of other voltages, set the voltage adjuster S5 in the power supply subassembly correspondingly. To this end take out the chassis from the casing (see Notes on Maintenance, page 3.1). For mains voltages of 110 or 130 v AC, the 0.6-amp fuse link in the fuse element on the front panel must be replaced with a 1.25-amp one. Such fuses are in the spares bag fastened to the chassis.

By resoldering the connecting cord on the power transformer from soldering lug 1a to soldering lug 2a the power supply unit can furthermore be set for a mains voltage of 230 v AC. In this connection the voltage adjuster must be set to 240 v AC.

In accordance with the safety regulations of the "Verein Deutscher Elektrotechniker" (VDE) (Association of German Electrical Engineers), all mains-powered appliances whose touch potential may exceed 65 v with respect to ground when a fault occurs must be equipped with a terminal for a protective grounding lead. For this reason the devices are provided with a power cord with a protective lead and a three-wire safety plug (Schuko plug) for insertion into a power outlet with protective ground (Schuko outlet).

The connecting facility and the cross section of the non-current-carrying protective lead must equal those of the live conductors. If the Schuko plug must be replaced with another (locally used) plug with a protective terminal, connect the three wires (red, gray, black) of the power cord as follows:

For non-polarized connector systems:

connect the red wire to the protective terminal;
the gray and black wires to the live terminals;

For polarized connector systems in mains with phase wire and neutral:

connect the red wire to the protective terminal,
the gray wire to the neutral terminal,
and the black wire to the "phase" terminal,

Furthermore, the device is equipped with a special terminal (⏚) on the front panel connected to ground.

II. ESTABLISHING THE MEASURING SETUP TOGETHER WITH THE LEVEL OSCILLATOR Type Rel 3 W 221

The ventilation of the devices and the built-in instruments have been designed for an arrangement in which the front panels are in a vertical position. The top of the devices should not be covered to allow the warm air to escape.

The annexed Figs. 1 and 2 show typical measuring setups for various measuring problems. To avoid measuring errors the connecting cords recommended should possibly be used.

The panel view (annexed Fig.1) shows the positions of the control and connecting elements, their lettering and symbols.

III. CALIBRATING AND SETTING

(see panel view, annexed Fig. 1)

Before energizing the level meter, check the mechanical zero point of the instrument ($-\infty$ on the scale) and adjust it with the correcting screw if required.

Operate the power switch S4 to ON; the indicating lamp in the turnbutton then lights up. About 15 minutes after the energization, calibration of the level meter can be started. The settings for wideband calibration and selective calibration are independent of each other and do not influence one another.

1. Calibration "▼I" for Wideband Measurements

Set the level range switch S2 at its left stop to the position indicated by the red "▼" and rotate the turnbutton T3 counterclockwise to the position "LOW-DISTORTION, ▼", press the button T1 "WIDEBAND, ▼I".

Subsequently adjust the meter pointer with the control knob R66 "▼I" (beside the panel meter) to the red calibrating mark.

2. Calibration "▼II" for Selective Measurements

During the calibrating procedure "▼II" the jack "SYNCHR f_1 +2.4 MC/S" must remain unconnected.

The level range switch S2 remains in position "▼" and the turnbutton T3 at "LOW-DISTORTION ▼". Press button T2 "SELECTIVE, ▼II" and maximize the deflection on the instrument with the frequency tuning control. The frequency scale must now be within the calibrating mark (70 kc/s). With the calibrating control R60 "▼II" set the meter pointer now to the red calibrating mark.

3. Input Impedance of the Level Meter and Termination of the Specimen

The input impedance of the level meter can be adapted to the impedance value+ of the specimen under test by means of the impedance switch S1. In a further position of the impedance switch the input impedance of the level meter is $\geq$ 10 kΩ (> 5 kΩ, > 3 kΩ)+ in balanced operation and $\geq$ 1 meg ‖ 60 pf in coaxial operation. These positions are used for measurements at points that are already terminated into their characteristic impedance.

+ see Description, page 1.3, Electrical Data for the different models

As a consequence of the design of the input circuit it occurs that in switch position Z > 1 meg ‖ 60 pf at high sensitivity and tuning to low frequencies the noise of the input impedance brings about a deflection on the instrument when the input is open (a condition never encoutered in practical measurements). The deflection decreases when the frequency increases since the characteristic impedance of the input circuit decreases too, because of the parallel connection of 1 meg and $\frac{1}{\omega Ce}$.

The impedance value corrections of the level meter model a3a (dbm) can also be activated in the case of balanced inputs of high impedance so that the power level can also be measured on terminated lines having these characteristic impedances.

In the models a2a (db) and a3a (dbm) some input impedances can be modified to the values stated in parentheses under Electrical Data. The instructions for this are given in the section "Notes on Maintenance", page 3.6.

IV. MEASURING PROCEDURES

A. Level, Attenuation, and Gain Measurements (annexed Fig. 1b)

1. Wideband Level Measurements

After setting the impedance switch S1 to the required image impedance and the line system (coaxial or balanced), connect the specimen to the input via a shielded cord. Press button T1 WIDEBAND, set button T3 to LOW-DISTORTION or LOW-NOISE (see under 3.). Set the level range switch S2 to a measuring range where the pointer of the instrument is possibly well up-scale.

The unknown level is found by adding the value shown in the illumunated window of the level range switch ("Koramat" automatic correction unit) and the instrument reading. If the lamp of the level range switch (Koramat) does no longer light, the measuring range limit for wideband level measurements is exceeded.

2. Selective Measurements (annexed Fig. 1b)

Set the impedance switch S1 as stated under "Wideband Measurements". To effect reconnection to selective measurements, press button T2 SELECTIVE. Set the level range switch S2 to the anticipated measuring range and tune the level meter with the frequency control f to the measuring frequency, i.e. to maximum instrument deflection; if required, readjust the level range switch.

The pass band for selective measurements is $f_m \pm 30$ c/s. Any levels of other frequencies present at the point of measurement are attenuated by more than 50 db (6 N), provided they are at least $\geq$ 400 c/s away from the measuring frequency f_m.

3. Measurement with Improved Signal-to-Noise ("low-noise")

Special measuring applications, e.g. the improvement of the relative measuring accuracy by "scale spreading" by means of the attachment Type Rel 3 B 942 or the presentation of curves on the screen of a level tracer, call for a high signal-to-noise ratio. By rotating the turnbutton T3 clockwise to position "LOW-NOISE" this ratio can be improved by 20 db (2 N). The sensitivity of the level is hence decreased by the same amount. One window further to the right is now illuminated on the automatic correction unit.

4. Measurements with Automatic Tuning (Synchr. Ext.) annexed Fig. 1b

Connect the jacks "SYNCHR f_1 +2.4 MC/S" of the level meter and the level oscillator by means of a coaxial cord (Type Rel ltg 533 d). Set with the fine frequency control f_2 in the level oscillator the fixed oscillator unit exactly to the first intermediate frequency (2.4 mc/s) of the level meter. To this end, set the oscillator, for instance, to p = 0 db (N), $Z \sim 0\ \Omega$, f = 100 kc/s and the level meter to p = 0 db(N), $Z \geq 1$ meg $\|$ 60 pf. Connect the level oscillator output to the level meter input, press the pushbutton T2 SELECTIVE. With the frequency control f_2 of the level oscillator tune the level meter for maximum deflection.

Insert the specimen under test between the level oscillator output and the level meter input. Set the desired transmitting frequency on the level oscillator only with the main frequency control f_1. In each case the level meter is then automatically kept tuned to the transmitting frequency. Read the measuring values in the same way as in any other measurement. Even though the stability in time of the oscillator frequencies suffices as a rule, the maximum deflection on the level meter should once more be checked and readjusted with the fine control f_2 of the level oscillator after the maximum operating temperature has been reached (approx. half an hour after energization).

B. Use of the Level Meter as Detector Amplifier

The level meter can also be used as a selective or wideband detector amplifier. The amplified input voltage or, in the case of selective measurements, the IF voltage (2 kc/s) is available at the jack OUTPUT AC, the open-circuit voltage at this output (Z_i = 600 Ω) corresponds to the level indicated on the instrument.

C. Crosstalk Attenuation Measurements

As described under section A.2 the carrier-frequency crosstalk of lines or circuits is selectively measured. In the case of near-end crosstalk attenuation measurements, connect the level oscillator to the beginning of the disturbing line and in the case of far-end crosstalk attenuation measurements, to the end of the disturbing line and the level meter always to the starting point of the disturbed line. The automatic tuning can be used in measuring the near-end crosstalk attenuation.

Set the level oscillator to the impedance value of the disturbing line (Z1) and the level meter to that of the disturbed line (Z2). Terminate the other (free) ends of the lines into individual resistors (Z1, Z2). The crosstalk attenuation equals the difference between the transmitting level and the measured receiving level. At a transmitting level of +10 db (+1 N) crosstalk attenuation of up to 120 db (13 N) can be measured in balanced circuits and of up to 140 db (15 N) in coaxial circuits.

D. Distortion Attenuation Measurements

In the "selective" setting the level meter is suited for measuring low distortion factors down to 0.1% (distortion attenuation of 60 db or 7 N).

The residual distortion attenuation depends on the fundamental level at the preamplifier and modulator Md1. If, for instance, the sensitivity for measuring the harmonic is increased by 60 db (7 N) as compared to the sensitivity for measuring the fundamental, the residual distortion attenuation is $\geq$ 80 db (9 N). Set the turnbutton T3 always to LOW DISTORTION.

For determining the distortion attenuation, measure first of all the fundamental level f_m. Tune subsequently the instrument successively to the harmonics 2 x f_m, 3 x f_m, etc. by increasing the sensitivity with S2 corresponding to the harmonic level. The difference between the fundamental level and the harmonic level is the distortion attenuation a_k for the respective (nth) harmonic.

As long as an increase of the sensitivity (up to about 60 db/7 N) brings about a correspondingly greater deflection on the instrument, the spacing with respect to the residual distortion voltage is still sufficient. If this is not the case an error may be introduced by residual distortion voltage.

From the distortion attenuation a_{kn} the distortion factor k_n for the nth harmonic can be calculated in percent as follows:

$$k_n = 100 \times 10^{\frac{-a_{kn}}{20}} \text{ in \% for } a_k \text{ in decibel}$$

$$k_n = 100 \times e^{-a_{kn}} \text{ in \% for } a_k \text{ in neper.}$$

For distortion attenuations of $a_{kn} > 20$ db the distortion factor of the measuring level is calculated as follows:

$$k = \sqrt{k_2^2 + k_3^2 + \ldots k_n^2} \text{ in \%}$$

E. Impedance Measurements by Magnitude (annexed Fig. 2b)

The impedance can be measured on a wideband or selective basis. Selective measurements are recommended whenever noise levels or harmonics may affect the measuring result. A high noise level can above all be anticipated in case of non-shielded specimens of large size, for instance open-wire lines. Harmonics will mostly disturb when the impedances are highly dependent on the frequency.

With the automatic tuning system selective measurements can here just as simply be carried out as wideband measurements.

Before performing the measurement, calibrate the measuring attachment. To this end, connect the specimen under test to jack R_X and the level oscillator Type Rel 3 W 221 to jack "LEVEL OSCILLATOR, Z~0 Ω" by means of a shielded balanced connecting cord. Set on the level oscillator Z~0 Ω, p = 10 db (1.15 N) and the measuring frequency f_m and on the level meter the impedance switch S1 at the right-hand stop to position "MEASURING ATTACHMENT ▼", the level range switch S2 to -40 db (dbm, -5 N), and the button T3 to LOW DISTORTION.

Set the switch IMPEDANCE S3 to "▼", the pushbuttons T1, T2 to wideband or selective depending to the mode of measuring employed and, in case of selective measuring, tune the level meter to the measuring frequency or use the automatic tuning system, as described in section A.4. Adjust the level meter pointer to the blue calibrating mark with the fine level control on the level oscillator. All settings of the switches S1, S2 and S3 required for calibrating the measuring attachment are marked in blue for facilitating the calibrating procedure.

For the measurement select the measuring range with switch S3 so that the measured value can be clearly read on one of the two ohm-scales of the instrument. The measuring value is the product of the measuring range set (x1, x10, or x100) multiplied by the value read on the ohm-scale lettered in the same color.

F. Measuring Balance-to-Unbalance Ratios (Common-Mode Suppression (Annexed Fig. 2b)

For determining the common-mode suppression a_{uns} with respect to ground, for instance of a line, a transformer, balanced filter, etc., connect the specimen to jack R_X and the level oscillator with Z~0 Ω, p = 10 db (1.15 N) and the desired measuring frequency to jack "G~" via a balanced connecting cord.

Due to the automatic tuning system selective measurements are here also just as simple as wideband measurements. For finding out whether to effect the measurements on a selective or wideband basis, see the statements made under section E.

Settings on the level meter: S1 to "MEAS ATTACHMENT ▼", S3 to UNBALANCE, pushbuttons T1, T2 optionally to SELECTIVE or WIDEBAND, T3 to LOW DISTORTION. In the case of selective measurements without automatic tuning tune for maximum instrument deflection with frequency control f. Set the level range switch S2 so that the indication on the instrument is well readable. When using the automatic tuning system for the measurements, observe the instructions for use of section A.4.

The common-mode suppression a_{uns} equals the level meter reading with sign reversed. It corresponds to the expression:

$$a_{uns} = \log_e \left| \frac{R_{X1} + R_{X2}}{R_{X1} - R_{X2}} \right| \quad \text{in nepers or}$$

$$a_{uns} = 20 \log_{10} \left| \frac{R_{X1} + R_{X2}}{R_{X1} - R_{X2}} \right| \quad \text{in decibels}$$

G. Measuring Reflection Ratios (Return Loss) (annexed Fig. 2b)

The reflection ratio a_r (return loss) has to be measured to obtain a high transmission quality if in a transmission system different components are to be interconnected, for instance when line sections having different characteristic impedances are interconnected by means of matching transformers. If one cable section is connected to jack R_X, and the one to be matched via a corresponding transformer to jack R_N, the return loss measured is representative of the mismatch or the reflection coefficient.

Return loss:

$$a_r = \log_e \left| \frac{R_X + R_N}{R_X - R_N} \right| = \log_e \left| \frac{1}{r} \right| \quad \text{in nepers or}$$

$$a_r = 20 \log_{10} \left| \frac{R_X + R_N}{R_X - R_N} \right| = 20 \log_{10} \left| \frac{1}{r} \right| \quad \text{in decibels}$$

Reflection coefficient:

$$r = 100 \times e^{-ar} \quad \text{in \% if } a_r \text{ in nepers or}$$

$$r = 100 \times 10^{-ar/20} \quad \text{in \% if } a_r \text{ in decibels}$$

If the specimen is compared with a complex impedance (e.g. series connection of C and R) connected to the terminals R_N, the maximum return loss (minimum deflection on the instrument) of the complex impedance corresponds to the impedance of the specimen with respect to magnitude and phase.

For the selection of the "wideband or selective" mode of operation the statements made under section E. apply.

For measuring the return loss, connect the specimen or the line to be measured to jack R_X, the reference object or balancing network R_N, and the level oscillator to jack "LEVEL OSCILLATOR, Z ~ 0 Ω" via balanced connecting cords. Turn switch S3 on the level meter to position RETURN LOSS; all other settings on the level oscillator and level meter as described under section F. At a transmitting level of +10 db (+1.15 N) the return loss equals the value indicated on the level meter with sign reversed. The return loss generally depends mainly on the frequency. Frequency-dependent maxima and minima result in the case of mismatch. The lowest return loss measured is always specified for a definite frequency range. The place where the mismatch originates can be calculated from the frequency separation between the maxima and minima as distance (l) from the measuring point. The following applies:

$$l = \frac{v}{2 \times \Delta f}$$

The distance (l) results in km if v = propagation time of the cable is inserted in m/µsec and Δf = frequency separation in kc/s.

H. Attachments (annexed Fig. 2c)

1. Graphic Recorder

A DC output (OUTPUT DC) is provided on the level meter for connecting recorders. The use of a graphic recorder is recommended when measurements are to be carried out for some time (continuous supervision), for instance for finding short interruptions occurring in a line section. For recording purposes, for instance in preparing acceptance records in test rooms, the recorder can also be employed. When selecting the recorder it should be seen to it that the transient behavior of the graphic recorder corresponds to the measuring task.

a. Voltage Recorder

Connect the voltage recorder (3 v/30 kΩ, 100 µa for full-scale deflection) to the jack OUTPUT DC between the a- and c-wires. Use a balanced 3-pole connector or insert a dummy plug in the b-wire (switching contact). Connect high-impedance (> 300 kΩ) voltage recorders only to the a- and c-wires, the b-wire remains unconnected.

b. Current Recorder

Connect the current recorder (77.5 µa/2.5 kΩ) to the jacks OUTPUT DC between the a- and b-wires.

Suitable graphic recorders are for instance:

The µA-Multizet recorder 12 K/T, Cat. No. 258 424 with the µA-Extra Multizet meter Cat. No. 258 429

2. Connection of a Scale-Spread Device

Connect the scale-spread device Type Rel 3 B 942 or Rel 3 B 977 via a balanced cord to jack OUTPUT DC. When the deflection on the level meter is 0 db (0 dbm, 0 N) adjust the deflection on the scale-spread device also to 0 db (0 N) with the zero point control. Level differences between ±0.02 and ±1 db (±0.002 and ±0.1 N) can then be read. For improving the signal-to-noise ratio bring button T3 to position LOW NOISE.

3. Connection of Level Tracers, for instance, Type Rel 3 D 346

(annexed Fig. 2a)

Such devices can be connected to the output jack "~" if their impedance is sufficiently high with respect to 600 Ω. The b- and c-wires of the terminal jack are connected to chassis ground within the device. For improving the signal-to-noise ratio, turn button T3 to position LOW NOISE.

I. REPLACING TUBES

Malfunction of the device will generally be due to worn or defective tubes. For checking and replacing the tubes, take the chassis out of the casing. To this end put the device down so that the front panel is in a horizontal position and loosen the bare fastening screws on the front panel. Furthermore loosen the screws of the terminal bars (in the middle at top and bottom) until the bars disengage the front panel. Subsequently restore the device to its normal position (front panel vertical) and pull the chassis out of the casing.

Test the tubes in a tube tester, replace worn tubes and insert the new tubes or the tubes, whose data are still within the tolerance limits, at the same place in the device.

With the exception of tube 1 in the preamplifier all tubes can be exchanged without subsequent alignment. If tube 1 must be exchanged, check the noise voltage of the device and align it for a minimum with R7 (in the power supply unit). To this end connect an audio tube voltmeter, for instance Type Rel 3 U 133, to the output jack OUTPUT AC and effect the measurements stated in the following table. The input of the level meter must, in this connection, be unassigned. If the nominal values are not obtained, exchange tube 1 once more. If no tube voltmeter is available, the minimum alignment can also be carried out by reference to the basic deflection on the level meter.

Level meter setting	Turnbutton T3 in position	$V_o$ltage at output AC	Note
wideband $Z \geq 1$ meg ‖ 60 pf,coax. -60 db (-60 dbm,-7 N)	low-distortion	$\leq$ 30 mw	align for a minimum with R7 in the power supply unit
selective tuning to 100 kc/s Z = 75 Ω, coaxial -120 db (-110 dbm,-13 N)	low-distortion	$\leq$ 60 mw	

II. SWITCHES

The switches are self-cleaning and require no maintenance. Never treat contact surfaces with fat-dissolving or greasy agents.

III. REPLACING INDICATING LAMPS

The indicating lamps **have bayonet sockets. They can be pulled out by** pushing them slightly in , combined with a slight left-hand twist. Use for this purpose the lamp extractor contained in the spares bag (fastened to the inside of the device). All indicating lamps are accessible from the outside. The cover of the illuminated turnbutton T3 can be pulled forward after a slight twist to the right.

For replacing the lamps in the level range switch S2 (Koramat automatic correction unit) unscrew the turnbutton with the scale and the disk with the three windows. When replacing the parts the red ▼ sign must be above the center window when the switch is at the left stop.

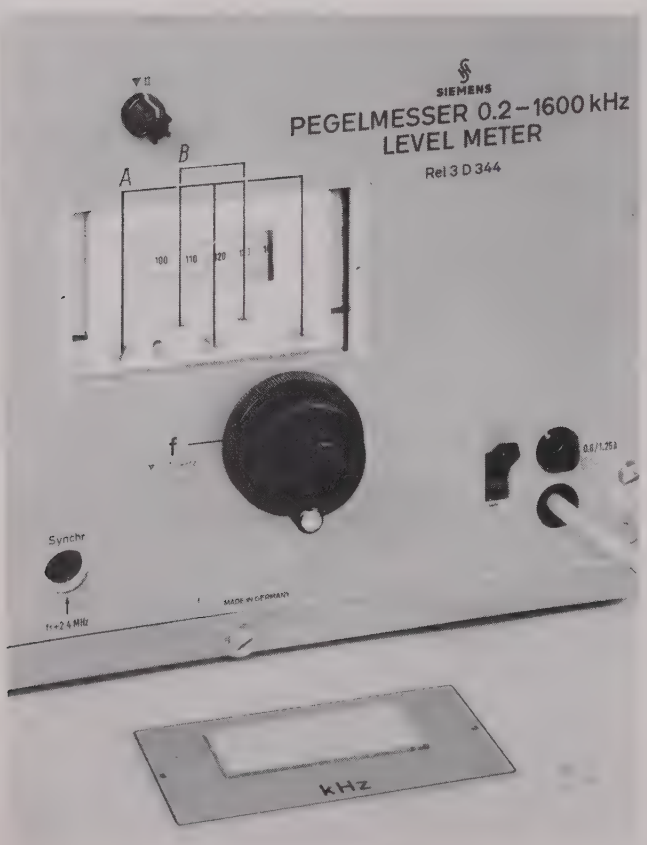


FIG.1 FREQUENCY SCALE DRIVE, WINDOW FRAME REMOVED

IV. FILM DRIVE, SCALE FILM

The film drive is very rugged and requires no maintenance. The film with the scale divisions, which are individually impressed in a photographing procedure, consists of an especially hard and resistant special plastic foil (Dupont Cronar film No. 225 B 35) in order to attain the high setting frequency accuracy. Under normal conditions no trouble will occur. If nevertheless a fault should crop up - for instance damage during transportation - take out the film magazine according to the instructions given below and find out the fault. Never try to move the drive by force. If the film is damaged, have a copy made on a film consisting of the same material. (Exception: Some devices of the first series include a spare film in the container attached to the film drive). If the film is damaged to such an extent that no copy can be made, the device has to be returned for repair and a new film scale will have to be made.

When exchanging the film proceed according to the following instructions:

A. Removal of the Film

The film magazine is accessible from the front. It is not necessary to unscrew the front panel or control knobs.

1. Rotate the film drive - as far as possible to its left stop (beginning of scale), otherwise do this after removing the film magazine.
2. Unscrew the window frame (Fig. 1).
3. Loosen the fastening screws (A) of the film guide and withdraw it in a forward direction (Fig. 1).
4. Wind the film completely onto reel C and loosen the adhesive tape from reel D (Fig. 3).
5. Unwind film from reel C and loosen adhesive tape from reel C. Remove the tapes carefully from the reels.

B. Inserting the New Film

Wind the spare film in such a way that the letterings for the high frequencies are readable at the outside. First of all remove the dust from the film guide with a soft brush, subsequently:

1. Hold reel C, turn the toothed reel E counterclockwise by four revolutions (the compensating spring in reel C is thus spanned) and lock it in this position by tightening the threaded pin F with a hexagon spanner 1.5 DIN 911 (contained in the spares bag), Fig.4.
2. Paste adhesive tape (40 mm x 19 mm), for instance Tesa tape D Ordering No. 5859 Beierdorf company, Hamburg, on the readable side of the film end so that 15 mm project (Fig. 2).
3. Paste the end of the film to reel C (Fig. 2). The edge of the film must then be in parallel to the edge of the reel.
4. Wind the film tightly onto the reel C (Fig. 3) and hold it until point 6 is carried out.
5. Thread the end of the film (beginning of the scale) through between the bearing block and counter part until it can be tightly pasted to reel D.
6. Paste the film to reel D as described under points 2 and 3 (Fig. 3).
7. Loosen the threaded pin F (Fig. 4). The spring tension must now become effective. If reel C is tightly held and the toothed reel E turned counterclockwise by 1/4 rotation, the toothed reel must return to its starting position when released.
8. Turn one toothed reel until the first unlettered scale mark exactly coincides with the index line in the scale window.
9. The film drive must be at the left stop.
10. Insert the film guide carefully without pressure and see to it that the film perforation engages the toothed rim.
11. Tighten the three fastening screws (A) of the film guide uniformly.
12. Screw the window frame on again.

C. Conveyor Belt

If the conveyor belt has to be exchanged due to damage, order a new one under the designation "conveyor belt C44106-A7-C109 with two clamps C44106-A7-C110". When inserting the belt, see to it that the lettering on the inside of the belt can be read. Insert the two clamps from the inside into the overlapping perforation and bend them over. Since the bias of the film roll is released when exchanging the conveyor belt, reinsert the film according to the instructions.

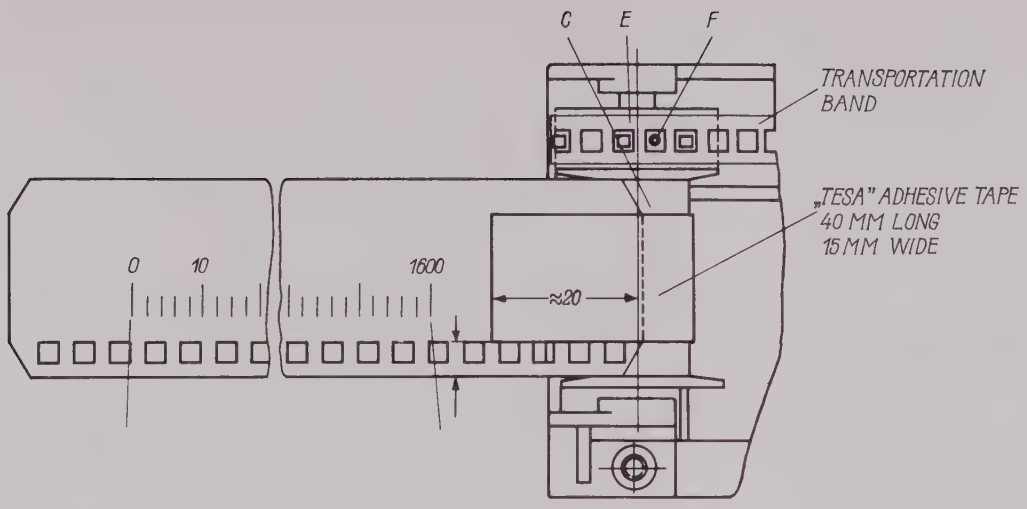


FIG. 2 CHEMENTING THE END OF THE FILM BAND IN POSITION

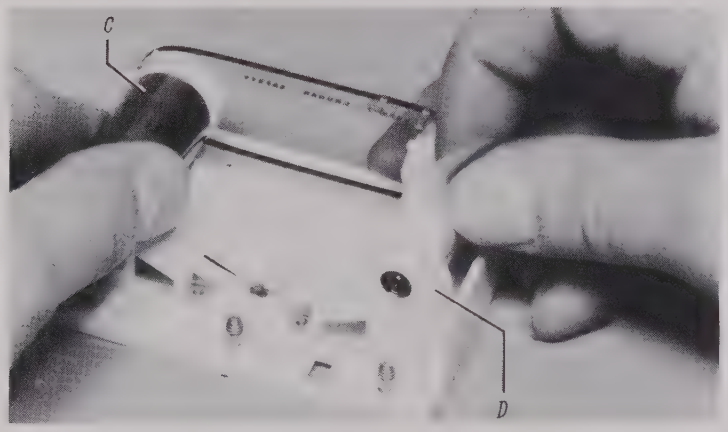


FIG. 3 CHEMENTING THE START OF THE FILM BAND IN POSITION

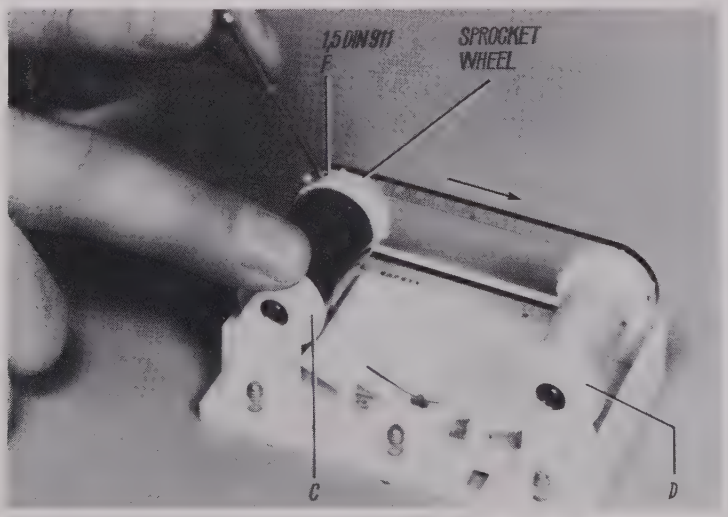
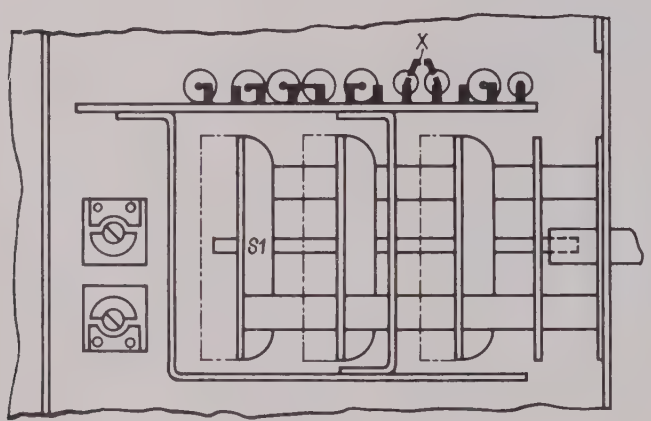


FIG. 4 RELEASING THE DETENT OF THE MECHANICAL BIAS

V. RECONNECTING THE DEVICES TO OTHER IMPEDANCE VALUES

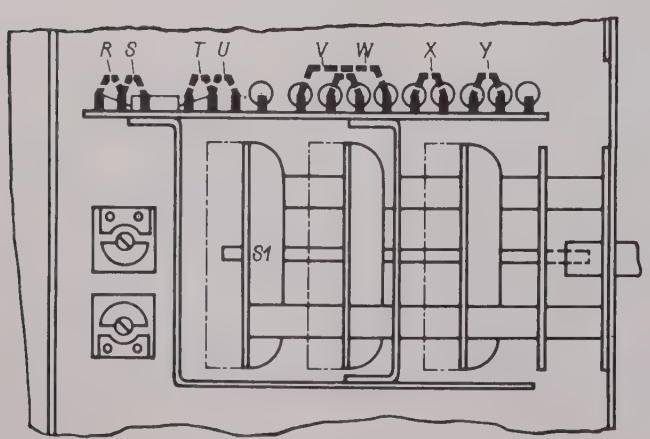
Some of the reconnectable input impedances of the level meter models a2a and a3a can, if required, be switched to other customary Z-values. They are stated in parentheses under "Electrical Data".

To this end, some wire links in the input subassembly have to be resoldered after removing the shielding cover (Figs. 5 and 6). The lettering plates for the impedance switch required for the possible modifications are fastened to the shielding cover of the measuring panel. Only for the combination 135, 150 Ω of model a3a order the name plate under the designation "plate for impedance switch C44249-A17-C28, lettered as per Rel besch 3 D 344 dt, En Bl. 4, Pos.3". The lettering plate on the impedance switch S1 can be exchanged after removing the control knob.



FOR CHANGING THE IMPEDANCE VALUE FROM 140 Ω TO 135 Ω, SOLDER IN LINK X

FIG.5
LEVEL METER MODES a2a (DB)



IMPEDANCE VALUE	LINKS REQUIRED
140/135 Ω	S, T, W, Y
140/125 Ω	S, U, V, W, X, Y
150/135 Ω	R, T

FIG.6
LEVEL METER MODEL a3a (DBM)

F A U L T L O C A T I N G

I. FAULT LOCATING ON THE DEENERGIZED DEVICE

1. First check the measuring setup. Check all terminal and connecting leads for a firm seat of the plugs and satisfactory condition (e.g., continuity of wires and shield).

2. If the device fails, check its power fuse.

3. Check whether an operating error has been committed on one of the devices forming part of the measuring setup.

4. Take the faulted chassis out of the casing. For this purpose, with the front panel horizontal, loosen the bare screws, restore the device to its normal position with the front panel vertical, and withdraw the slide-in chassis carefully by its handles.

5. Perform a visual inspection.

   Overloaded resistors and coils can often be detected by their discoloration (and possibly their smell). Before replacing such parts first ascertain the cause of the fault and eliminate it, e.g., by checking whether capacitors fed via the resistor are short-circuited. Check whether all tubes and crystals are perfectly seated in their sockets.

II. FAULT LOCATING ON THE ENERGIZED DEVICE

Caution: When applying power to the exposed chassis, observe the applicable safety regulations (e.g. in Germany the regulations of the VDE (Association of German Electrical Engineers)) concerning rooms with electric equipment. Entrust such work only to skilled personnel.

A. General Information

The principal information for fault locating is the circuit diagrams with the voltage data in the wiring diagrams' section and the chapters "Testing Instructions and Fault Eliminating" as well as the trouble-shooting plans in the annex (annexed Figs. 3, 4). If the observed fault is mentioned in the following fault locating table, a procedure as suggested there will often considerably reduce the fault locating work.

The remark "check forward and reverse resistance" in the case of crystal diodes refers to a simple measurement with a DC ohmmeter. If the forward and reverse resistances differ to any greater extent, it will be possible to rate the crystal diode as being in order to a first approximation. More accurate information will, of course, be obtained by measuring the respective characteristic data. All RF voltage (AC voltage) data are averaged from measurements made with the instruments listed on p.5.2 of the Fault Eliminating section. The accuracy of the stated measuring data is about ±15% unless other limits are specifically stated.

The photographs in the parts list section and the wiring diagrams in the circuit diagrams section facilitate the locating of the subassemblies, individual components, and measuring points. The wiring among the various subassemblies is shown in the wiring diagram Rel ms 3 D 344a.

III. FAULT LOCATING TABLE

Type of Fault	Fault Locating
" ▼I", " ▼II" and wideband and selective measurements not possible	Check according to annexed Fig. 3
Selective measuring and " ▼II" not possible	Check according to annexed Fig. 4
Selective measuring only possible with synchronization from the level oscillator Type Rel 3 W 221	Fault in oscillator unit 1 Type Rel 35 D 460a
" ▼I" and " ▼II" not possible, measuring level applied from outside is correctly indicated	Check the calibrating voltage in the oscillator unit 3
" ▼I" and " ▼II" can be carried out, but level indication is incorrect	See "Fault Eliminating", page 5.3, sections A and B
Astoundingly high parasitic deflection in the most sensitive ranges	Align the hum voltage on the most sensitive wideband range with R7 in the power supply unit for minimum indication, see "Notes on Maintenance" on page 3.1. Check the modulator Md1 as to its balance
Indication depens strongly on the mains voltage	Check the tubes 1, 2, 5, 6, 7, check the power supply unit Type Rel 35 D 463a, if need arises, replace stabilizer tube
Indication depend on frequency	See "Fault Eliminating", p.5.4, sect. A2
Level range switch S2 switches the level stages incorrectly	See "Fault Eliminating" p.5.5, sect. B

Type of Fault	Fault Locating
Indicating lamps in the "Koramat" automatic correction unit do not indicate the set measuring range correctly	See "Fault Eliminating", p.5.14, sect. 4
When the turnbutton T3 is set to "low noise", a wrong value is indicated	Relay K must operate, alignment with R85 in the amplifier and modulator subassemblies; in selective measuring additionally check the functioning of relays B and E according to the level plans in section B.
Frequency calibration is out of order; fault on the film feed	See "Fault Eliminating", p. 5.15, sect. C
With synchronization by the level oscillator Type Rel 3 W 221 the device fails to operate	Check relay H in the oscillator unit G1 (2.4 to 4.02 mc/s). When jack SYNCHR is short-circuited, relay H must operate
Low residual distortion attenuation	See "Fault Eliminating", p. 5.18, sect. F
Low image frequency attenuation	See "Fault Eliminating", p. 5.17, sect.2
No measurements possible with measuring attachment	See "Fault Eliminating", p. 5.19, sect. H
Zero point cannot be set on the scale-spread device Type Rel 3 B 942 when the indication on the level meter reads 0 db (dbm, N)	When the nominal deflection on the level meter is 0 db (dbm, N), align the instrument to 77.5 µa with R116 in the amplifier and converter subassembly when an ammeter with an internal impedance of 2.5 kΩ (µa Multizet meter) is connected to jack "OUTPUT DC"

I. GENERAL NOTES

Fault eliminating is based on the parts lists and circuit diagrams. When replacing defective parts avoid changing the positions of the wires. If unsoldered wires cannot be clearly distinguished by their color, mark them by pasted-on paper tags, for instance. Exercise great care when establishing new soldering points.

When replacing semiconductors (e.g. crystal diodes), proceed with particular care to avoid cracks on the lead through units which often consist of glass. Bend the wires over an edge, for instance over flat pliers (Fig. 1).

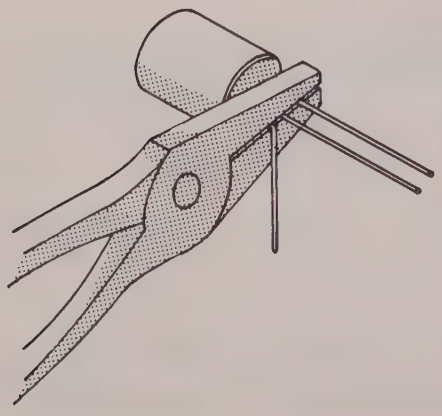


FIG.1
NEVER BEND TERMINAL WIRES DIRECTLY AT THE GLASS BASE, BUT OVER AN EDGE, e.g. THAT OF FLAT PLIERS

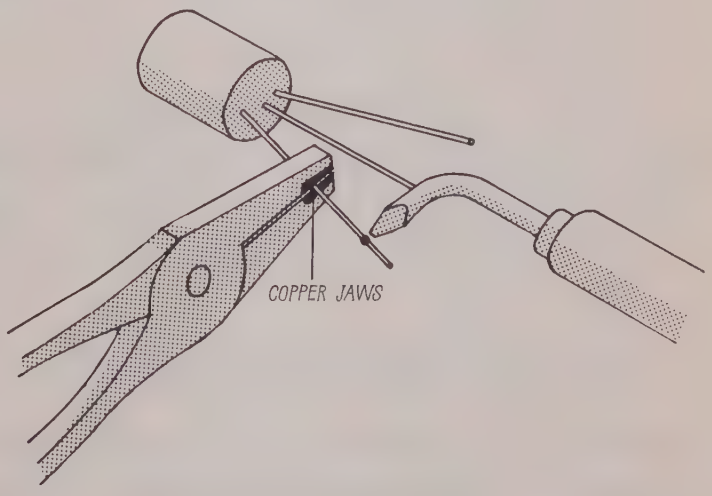


FIG.2
FOR SOLDERING USE FLAT PLIERS WITH COPPER JAWS AS HEAT SINK.

Semiconductors as well as small carbon-film resistors and Styroflex-capacitors are highly sensitive to temperature. Hence do not shorten the terminal wires of semiconductors and use a proper heat sink during soldering, for instance according to Fig.2.

Apart from detailed notes the following sections also include instructions for realigning and checking that must be carried out after repairing the individual subassemblies.

II. CHECKING INSTRUCTIONS AND FAULT ELIMINATING

This section includes the instructions for checking and aligning the electrical data of the level meter. Checking at regular intervals as well as fault eliminating is also based on these instructions.

Measuring Instruments Required

1 frequency counter up to 4 mc/s, error $\pm 1 \times 10^{-5}$
1 DC multimeter Zi = 50 kΩ/v
e.g. Siemens µa-Multizet meter, M-Cat.No. 231 252
1 RF diode or tube voltmeter
e.g. Siemens RF Multizet meter, 30 c/s to 450 mc/s, M-Cat. No. 231 504
1 calibrating meter for checking 0-db (dbm, N) marks
e.g. Type Rel 3 D 322
1 attenuator, e.g. Type Rel 3 D 112
1 selective level meter, e.g. Type Rel 3 D 335
1 variable power supply unit for setting the exact mains voltage and 10% overvoltage or undervoltage
1 level oscillator, frequency range 200 c/s to 1620 kc/s
e.g. Type Rel 3 W 221
1 low-distortion oscillator (distortion attenuation $\geq$ 100 db) for measuring the residual distortion attenuation.

If such an oscillator is not available, a transmitting voltage having a low enough distortion must be established for the frequency to be measured by inserting a low-pass filter.

A. Testing and Realigning the Level Indication

1. Checking the Calibrating Voltages in the Wideband and the Selective Range

a. Wideband

Settings on the level meter:
Bring the level range switch S2 to position 0 db (0 dbm, 0 N), the impedance switch S1 to position Z > 10 kΩ (in the case of the level meter for a power level as referred to 600 Ω) balanced, turnbutton T3 to position "LOW-DISTORTION, ▼" and press pushbutton T1 WIDEBAND.

Measuring circuit:
Connect the calibrating level meter across the balanced input of the level meter and inject with the level oscillator (Zi ~ 0 Ω, f = 100 kc/s) a signal of exactly 0 db (0 N). Adjust the deflection on the level meter to the 0-db scale mark (dbm, N) (▼) with R66 " ▼I".

Check and realignment:
Bring the level range switch S2 to position "▼". The calibrating voltage is in order when the instrument pointer also is at the calibrating mark "▼" (0 db, 0 dbm, 0 N).

In the case of deviations, adjust the deflection on the instrument with R135 in the transformer subassembly Type Rel 35 D 461a (oscillator unit 3).

b. Selective

Settings on the level meter and measuring circuit:
Settings and injection as under a; press the pushbutton T2 SELECTIVE, tune the level meter with the frequency control (100 kc/s) for maximum indication, and adjust the meter deflection to 0 db (dbm, N) (▼) with "▼II".

Check and realignment:
Bring the level range switch S2 to position "▼" and maximize the meter deflection with the frequency control (70 kc/s, ▼). If the magnitude of the calibrating voltage is correct, the instrument pointer is again at the calibrating mark (0 db, dbm, N).

Realignment of the calibrating voltage ▼II is possible with R10 in the measuring field Type Rel 35 D 458a.

2. Frequency Resonce of the Level Indication

a. Wideband

Settings on the level meter and measuring circuit as under 1a. Keep the signal-feeding level constant at all measuring frequencies.

The frequency response of the indication as referred to 100 kc/s must remain within ±0.2 db (±0.02 N).

Carry out the same measurement via the coaxial input. Bring the impedance switch S1 to > 1 meg ‖ 60 pf.

In the case of deviations from the nominal values, the frequency response of the high frequencies can be improved at the coaxial input with the trimmer capacitor C87 (in the amplifier and transformer subassembly Type Rel 35 D 461a) at the tube CCa7. In the case of a balanced input the frequency response can be subsequently aligned with C12 in the measuring panel (input subassembly Type Rel 35 D 539a).

b. Selective

Settings on the level meter and measuring circuit as under 1a, pushbutton T2 SELECTIVE, however, pressed.

If the frequency response is outside the permissible limits (±0.2 db, ±0.02 N as referred to 100 kc/s), measure the diodes of modulator Md1 and check the symmetry alignment as follows:
Measuring circuit as under 1a (feed in a signal of 100 kc/s, 0 db), press button T2 SELECTIVE and tune the level meter to 100 kc/s. Connect a selective level meter (f = 2.5 mc/s) to the measuring jack "M3", effect tuning at 2.5 mc/s and minimize the deflection with the variable resistor R12 at modulator Md1.

3. Mains Voltage Dependence of the Level Indication

Inject a signal of 0 db (0 N) at nominal mains voltage. At mains voltage variations of ±10% the indication may vary by ±0.2 db (±0.2 N) in the wideband and selective measuring range. At greater variations of the indication, check the power supply unit, by reference to the circuit diagram Rel str 3 D 344..., and all tubes.

B. Level Range Switch S2

1. General Notes on the Fault Tracking

The following illustrations and tables shall contribute to a better understanding of sensitivity switching by means of attenuators, connected in various combinations and different gains, and thus to a rapid location of the faults.

a. Sensitivity Switching in "Wideband" Measurements (Figs. 3 to 5)

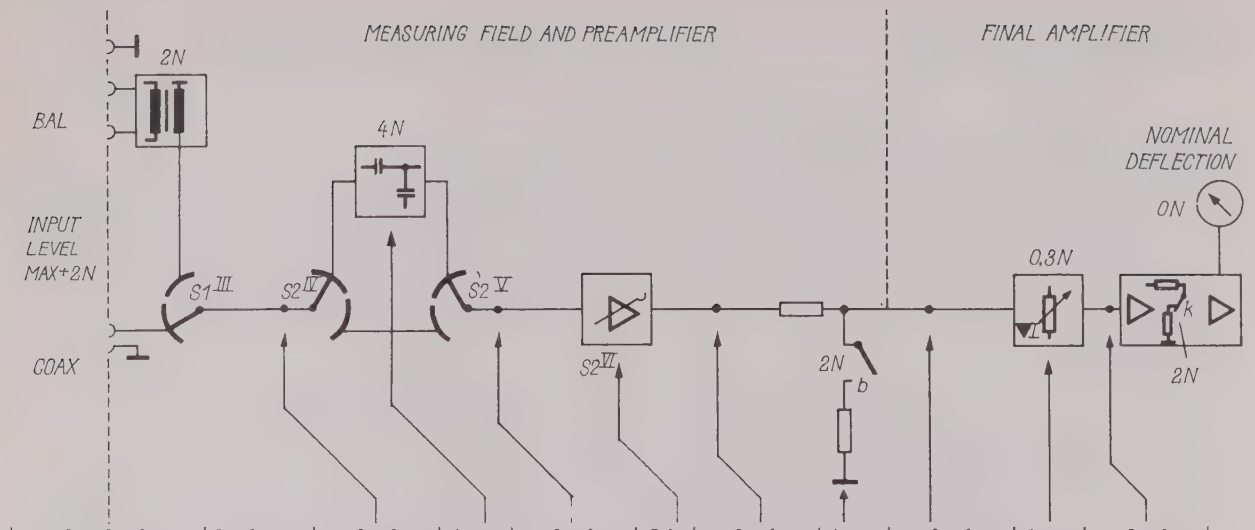
When the button T1 WIDEBAND is pressed, the connection from the preamplifier output to the final amplifier input is established via the contacts of relays C and F, the heterodyning section being bypassed.

The sensitivity is switched
by the 40-db (4-N) divider (C-divider) with the switches $S2^{IV}$ and $S2^{V}$,
by changing the degenerative divider resistances of the preamplifier in steps with switch $S2^{VI}$,

by activating the 20-db (2-N) divider (R-divider) at the output of the preamplifier with relay B via switch $S2^{III}$ and by connecting the 20-db (2-N) divider (R-divider) in the final amplifier with relay K via the turnbutton $T3^{VII}$ for the mode of measuring "low-distortion".

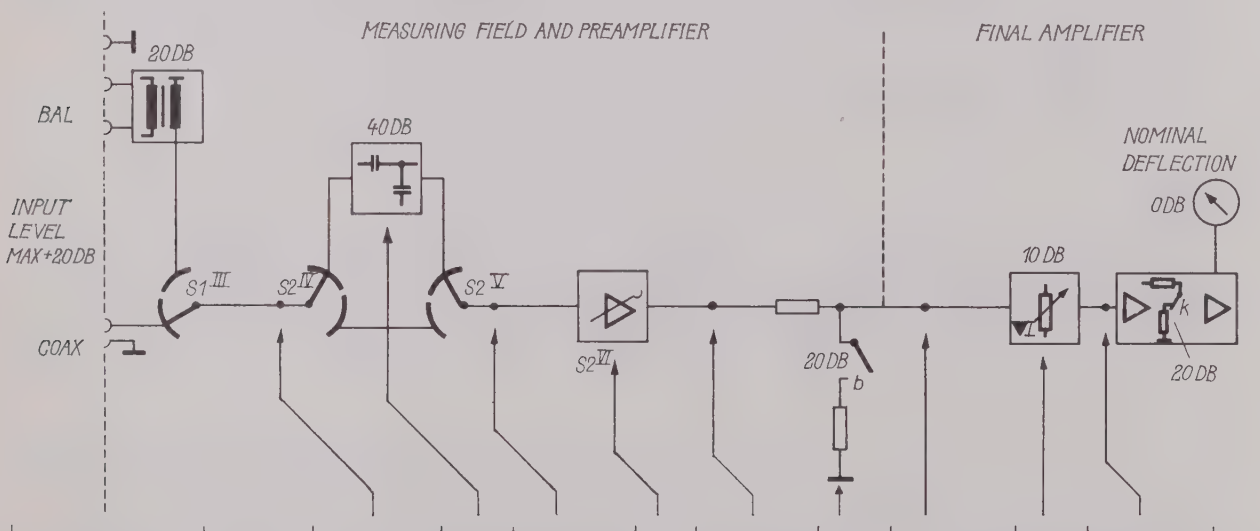
Note

In the circuit diagrams all relays are shown deenergized. The windings of the relays are designated by capital letters (e.g. A, B, C) and the corresponding contacts by small letters (e.g. a, b, c).



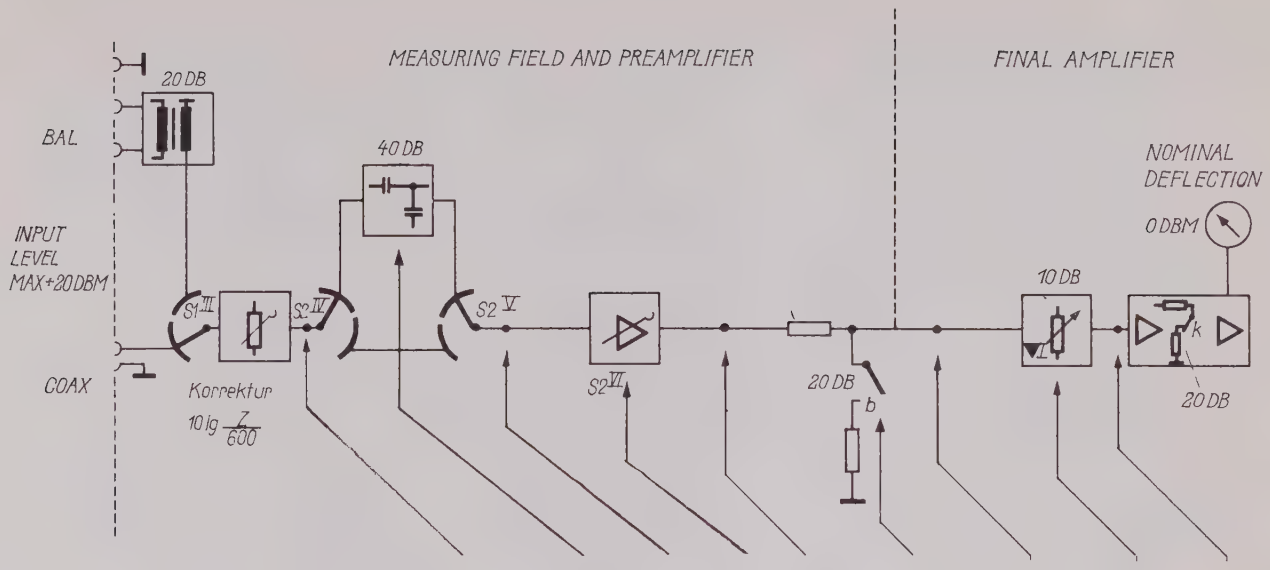
Input Level bal.	Input Level coax.	Input Level bal.	Input Level coax.	Level range switch S2 in pos.	Level T3 in position low distor.	Level T3 in position low noise	Atten-uation	Level T3 in position low distor.	Level T3 in position low noise	Gain	Level T3 in position low distor.	Level T3 in position low noise	Atten-uation	Level T3 in position low distor.	Level T3 in position low noise	Atten-uation	Level T3 in position low distor.	Level T3 in position low noise	
T3 in position low distor.		T3 in position low noise																	
I		-		1	-	-	-	-5	-	0,7	-4,3	-	0	-4,3	-	0,3	-4,6	-	
+2	0	-	+2	4	0	+2	4	-4	-2	1,7	-2,3	-0,3	2	-4,3	-2,3	0,3	-4,6	-2,6	
+1	-1	-	+1	5	-1	+1	4	-5	-3	0,7	-4,3	-2,3	0	-4,3	-2,3	0,3	-4,6	-2,6	
0	-2	+2	0	6	-2	0	4	-6	-4	1,7	-4,3	-2,3	0	-4,3	-2,3	0,3	-4,6	-2,6	
-1	-3	+1	-1	7	-3	-1	0	-3	-1	0,7	-2,3	-0,3	2	-4,3	-2,3	0,3	-4,6	-2,6	N
-2	-4	0	-2	8	-4	-2	0	-4	-2	1,7	-2,3	-0,3	2	-4,3	-2,3	0,3	-4,6	-2,6	
-3	-5	-1	-3	9	-5	-3	0	-5	-3	0,7	-4,3	-2,3	0	-4,3	-2,3	0,3	-4,6	-2,6	
-4	-6	-2	-4	10	-6	-4	0	-6	-4	1,7	-4,3	-2,3	0	-4,3	-2,3	0,3	-4,6	-2,6	
-5	-7	-3	-5	11	-7	-5	0	-7	-5	2,7	-4,3	-2,3	0	-4,3	-2,3	0,3	-4,6	-2,6	

FIG.3 LEVEL PLAN FOR "WIDEBAND" MEASUREMENTS, LEVEL METER Type Rel 3 D 344a1a (N)



Input Level bal.	Input Level coax.	Input Level bal.	Input Level coax.	Level range switch S2 in pos.	Level T3 in position low distor.	Level T3 in position low noise	Atten-uation	Level T3 in position low distor.	Level T3 in position low noise	Gain	Level T3 in position low distor.	Level T3 in position low noise	Atten-uation	Level T3 in position low distor.	Level T3 in position low noise	Atten-uation	Level T3 in position low distor.	Level T3 in position low noise	
T3 in position low distor.		T3 in position low noise																	
I		-		1	-	-	-	-40	-	10	-30	-	0	-30	-	10	-40	-	
+20	0	+20	+20	4	0	+20	40	-40	-20	10	-30	-10	0	-30	-10	10	-40	-20	
+10	-10	+10	+10	5	-10	+10	40	-50	-30	20	-30	-10	0	-30	-10	10	-40	-20	
0	-20	0	0	6	-20	0	0	-20	0	10	-10	+10	20	-30	-10	10	-40	-20	db
-10	-30	-10	-10	7	-30	-10	0	-30	-10	20	-10	+10	20	-30	-10	10	-40	-20	
-20	-40	-20	-20	8	-40	-20	0	-40	-20	10	-30	-10	0	-30	-10	10	-40	-20	
-30	-50	-30	-30	9	-50	-30	0	-50	-30	20	-30	-10	0	-30	-10	10	-40	-20	
-40	-60	-40	-40	10	-60	-40	0	-60	-40	30	-30	-10	0	-30	-10	10	-40	-20	

FIG.4 LEVEL PLAN FOR "WIDEBAND" MEASUREMENTS, LEVEL METER Type Rel 3 D 344a1a (DB)



Input Level bal.	coax. S1 in position 1 to 3	4	bal.	coax. S1 in position 1 to 3	4	Level range switch S2 in pos.	Level T3 in position low distor.	low noise	Atten-uation	Level T3 in position low distor.	low noise	Gain	Level T3 in position low distor.	low noise	Attenuation T3 in position low distor.	low noise	Level T3 in position low distor.	low noise	Atten-uation	Level T3 in position low distor.	low noise
T3 in position low distortion			T3 in position low noise																		
I	-	-	-	-	-	1	-	-	-	-40	-	10	-30	-	0	-	-30	-	10	-40	-
+20	0	-10	-	+20	+10	4	-10	+10	40	-50	-30	20	-30	-10	0	0	-30	-10	10	-40	-20
+10	-10	-20	-	+10	0	5	-20	0	0	-20	0	10	-10	+10	20	20	-30	-10	10	-40	-20
0	-20	-30	+20	0	-10	6	-30	-10	0	-30	-10	20	-10	+10	20	20	-30	-10	10	-40	-20
-10	-30	-40	+10	-10	-20	7	-40	-20	0	-40	-20	10	-30	-10	0	0	-30	-10	10	-40	-20
-20	-40	-50	0	-20	-30	8	-50	-30	0	-50	-30	20	-30	-10	0	0	-30	-10	10	-40	-20
-30	-50	-60	-10	-10	-40	9	-60	-40	0	-60	-40	30	-30	-10	0	0	-30	-10	10	-40	-20
dbm							db														

FIG.5 LEVEL PLAN FOR "WIDEBAND" MEASUREMENTS, LEVEL METER Type Rel 3 D344a3a (DBM)

b. Sensitivity Switching in "Selective" Measurements (Figs. 6 to 8)

When button T2 SELECTIVE is depressed, relays C, F, and G are operated and the heterodyning section is thus interposed between the preamplifier and final amplifier (contacts c and f). Relay G connects a 2-kc/s resonant circuit across the earphone output, the signal-to-noise ratio as compared to other signals is thus improved.

The sensitivity is switched at the following six points combined:

by the 30-db (3-N) divider (C-divider) following the impedance switch, which is operated by relay A via $S2^{II}$ and $T2^{IV}$;

by the 40-db (4-N) divider (C-divider) in front of the preamplifier via $S2^{IV}$ and $S2^{V}$;

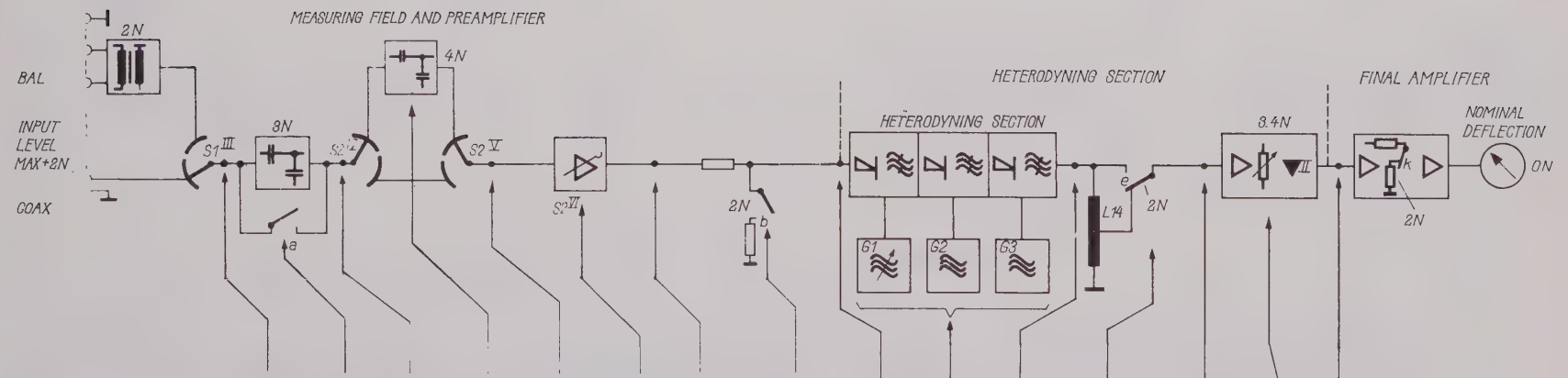
by changing the degeneration of the preamplifier in steps with switch $S2^{VI}$;

by activating the 20-db (2-N) divider (R-divider) at the output of the preamplifier with relay B via the switches $S2^{III}$, $T2^{III}$, and $T3^{VIII}$;

with the 20-db (2-N) divider (L-divider) at the output of the 2-kc/s filter by relay E via switches $S2^{II}$, $T2^{V}$, and $T3^{I}$,

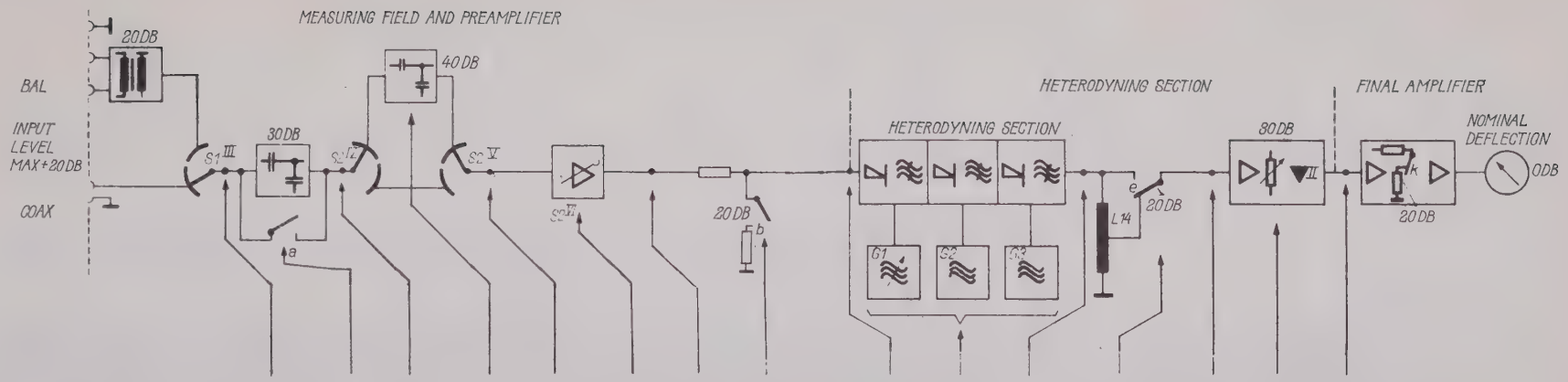
and by connecting the 20-db (2-N) divider (R-divider) in the final amplifier with the relay K via the turnbutton $T3^{VII}$ for the mode of measurement "low-distortion".

When, for instance, on a level meter Type Rel 3 D 344a2a (db) the same indication error comes about in the wideband ranges +10, -10 and -30 db and in the selective ranges +10, -10, -30, -60, and -80 db, as referred to the balanced input (S1), and when the turnbutton T3 is in position LOW-DISTORTION, the fault must be caused by the resistive 20-db divider in the degenerative path of the preamplifier. Realignment can be effected with R64 in this divider.



Input Level bal.	Input Level coax.	Input Level bal.	Input Level coax.	Level range switch S2 in pos.	Level T3 in position low distor.	Level T3 in position low noise	Atten-uation	Level T3 in position low distor.	Level T3 in position low noise	Atten-uation	Level T3 in position low distor.	Level T3 in position low noise	Gain	Level T3 in position low distor.	Level T3 in position low noise	Attenuation T3 in position low distor.	Attenuation T3 in position low noise	Level T3 in position low distor.	Level T3 in position low noise	Gain	Level T3 in position low distor.	Level T3 in position low noise	Attenuation T3 in position low distor.	Attenuation T3 in position low noise	Level T3 in position low distor.	Level T3 in position low noise	Gain	Level T3 in position low distor.	Level T3 in position low noise	
II		-		1	-	-	-	-	-	-	-8	-	0,7	-7,3	-	0	-	-7,3	-	1,3	-6	-	2	-	-8	-	3,4	-4,6	-	
+2	0	-	+2	4	0	+2	3	-3	-1	4	-7	-5	1,7	-5,3	-3,3	2	2	-7,3	-5,3	1,3	-6	-4	2	2	-8	-6	3,4	-4,6	-2,6	
+1	-1	-	+1	5	-1	+1	3	-4	-2	4	-8	-6	0,7	-7,3	-5,3	0	0	-7,3	-5,3	1,3	-6	-4	2	2	-8	-6	3,4	-4,6	-2,6	
0	-2	+2	0	6	-2	0	3	-5	-3	4	-9	-7	1,7	-7,3	-5,3	0	0	-7,3	-5,3	1,3	-6	-4	2	2	-8	-6	3,4	-4,6	-2,6	
-1	-3	+1	-1	7	-3	-1	3	-6	-4	0	-6	-4	0,7	-5,3	-3,3	2	2	-7,3	-5,3	1,3	-6	-4	2	2	-8	-6	3,4	-4,6	-2,6	
-2	-4	0	-2	8	-4	-2	3	-7	-5	0	-7	-5	1,7	-5,3	-3,3	2	2	-7,3	-5,3	1,3	-6	-4	2	2	-8	-6	3,4	-4,6	-2,6	
-3	-5	-1	-3	9	-5	-3	3	-8	-6	0	-8	-6	0,7	-7,3	-5,3	0	0	-7,3	-5,3	1,3	-6	-4	2	2	-8	-6	3,4	-4,6	-2,6	
-4	-6	-2	-2	10	-6	-4	3	-9	-7	0	-9	-7	1,7	-7,3	-5,3	2	0	-9,3	-5,3	1,3	-8	-4	0	2	-8	-6	3,4	-4,6	-2,6	
-5	-7	-3	-5	11	-7	-5	3	-10	-8	0	-10	-8	2,7	-7,3	-5,3	2	0	-9,3	-5,3	1,3	-8	-4	0	2	-8	-6	3,4	-4,6	-2,6	N
-6	-8	-4	-6	12	-8	-6	0	-8	-6	0	-8	-6	0,7	-7,3	-5,3	2	0	-9,3	-5,3	1,3	-8	-4	0	2	-8	-6	3,4	-4,6	-2,6	
-7	-9	-5	-7	13	-9	-7	0	-9	-7	0	-9	-7	1,7	-7,3	-5,3	2	0	-9,3	-5,3	1,3	-8	-4	0	2	-8	-6	3,4	-4,6	-2,6	
-8	-10	-6	-8	14	-10	-8	0	-10	-8	0	-10	-8	0,7	-9,3	-7,3	0	0	-9,3	-7,3	1,3	-8	-6	0	0	-8	-6	3,4	-4,6	-2,6	
-9	-11	-7	-9	15	-11	-9	0	-11	-9	0	-11	-9	1,7	-9,3	-7,3	0	0	-9,3	-7,3	1,3	-8	-6	0	0	-8	-6	3,4	-4,6	-2,6	
-10	-12	-8	-10	16	-12	-10	0	-12	-10	0	-12	-10	2,7	-9,3	-7,3	0	0	-9,3	-7,3	1,3	-8	-6	0	0	-8	-6	3,4	-4,6	-2,6	
-11	-13	-9	-11	17	-13	-11	0	-13	-11	0	-13	-11	3,7	-9,3	-7,3	0	0	-9,3	-7,3	1,3	-8	-6	0	0	-8	-6	3,4	-4,6	-2,6	

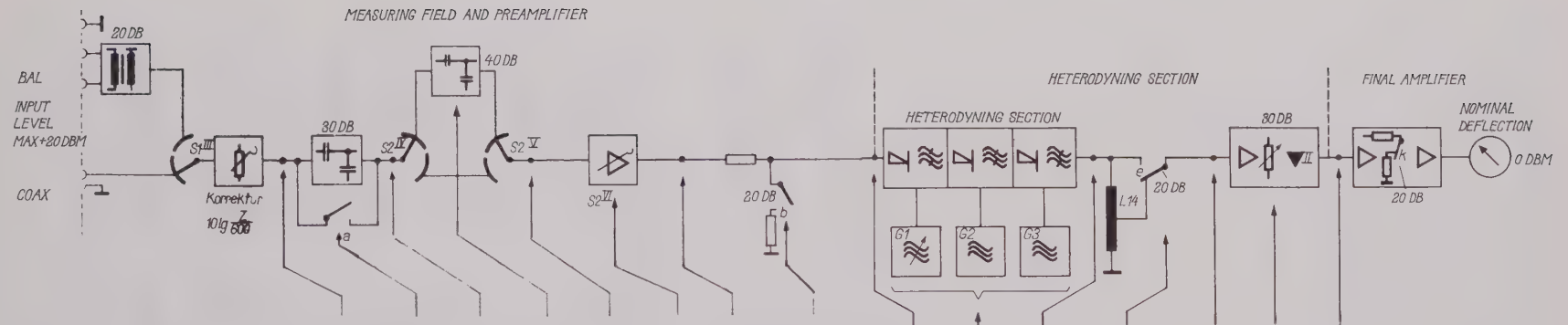
FIG. 6 LEVEL PLAN FOR THE "SELECTIV" MEASURING MODE, LEVEL METER Type Rel 3 D 344a1a (N)



Input Level bal. coax. T3 in position low distor.		bal. coax. low noise		Level range switch S2 in pos.	Level T3 in position low distor.	low noise	Atten-uation	Level T3 in position low distor.	low noise	Atten-uation	Level T3 in position low distor.	low noise	Gain	Level T3 in position low distor.	low noise	Attenuation T3 in position low distor.	low noise	Level T3 in position low distor.	low noise	Gain	Level T3 in position low distor.	low noise	Attenuation T3 in position low distor.	low noise	Level T3 in position low distor.	low noise	Gain	Level T3 in position low distor.	low noise	
II		-		1	-	-	-	-	-	-	-70	-	10	-60	-	0	-	-60	-	10	-50	-	20	-	-70	-	30	-40	-	
+20	0	-	+20	4	0	+20	30	-30	-10	40	-70	-50	10	-60	-40	0	0	-60	-40	10	-50	-30	20	20	-70	-50	30	-40	-20	
+10	-10	-	+10	5	-10	+10	30	-40	-20	40	-80	-60	20	-60	-40	0	0	-60	-40	10	-50	-30	20	20	-70	-50	30	-40	-20	
0	-20	+20	0	6	-20	0	30	-50	-30	0	-50	-30	10	-40	-20	20	20	-60	-40	10	-50	-30	20	20	-70	-50	30	-40	-20	
-10	-30	+10	-10	7	-30	-10	30	-60	-40	0	-60	-40	20	-40	-20	20	20	-60	-40	10	-50	-30	20	20	-70	-50	30	-40	-20	
-20	-40	0	-20	8	-40	-20	30	-70	-50	0	-70	-50	10	-60	-40	0	0	-60	-40	10	-50	-30	20	20	-70	-50	30	-40	-20	
-30	-50	-10	-30	9	-50	-30	30	-80	-60	0	-80	-60	20	-60	-40	20	0	-80	-40	10	-70	-30	0	20	-70	-50	30	-40	-20	
-40	-60	-20	-40	10	-60	-40	30	-90	-70	0	-90	-70	30	-60	-40	20	0	-80	-40	10	-70	-30	0	20	-70	-50	30	-40	-20	
-50	-70	-30	-50	11	-70	-50	0	-70	-50	0	-70	-50	10	-60	-40	20	0	-80	-40	10	-70	-30	0	20	-70	-50	30	-40	-20	
-60	-80	-40	-60	12	-80	-60	0	-80	-60	0	-80	-60	20	-60	-40	20	0	-80	-40	10	-70	-30	0	20	-70	-50	30	-40	-20	
-70	-90	-50	-70	13	-90	-70	0	-90	-70	0	-90	-70	10	-80	-60	0	0	-80	-60	10	-70	-50	0	0	-70	-50	30	-40	-20	
-80	-100	-60	-80	14	-100	-80	0	-100	-80	0	-100	-80	20	-80	-60	0	0	-80	-60	10	-70	-50	0	0	-70	-50	30	-40	-20	
-90	-110	-70	-90	15	-110	-90	0	-110	-90	0	-110	-90	30	-80	-60	0	0	-80	-60	10	-70	-50	0	0	-70	-50	30	-40	-20	
-100	-120	-80	-100	16	-120	-100	0	-120	-100	0	-120	-100	40	-80	-60	0	0	-80	-60	10	-70	-50	0	0	-70	-50	30	-40	-20	

db

FIG.7 LEVEL PLAN FOR THE "SELECTIVE" MEASURING MODE, LEVEL METER Type Rel 3 D344a2a (DB)



Input Level bal.	Input Level coax. S1 in position 1 to 3	Input Level coax. S1 in position 4	Input Level bal.	Input Level coax. S1 in position 1 to 3	Input Level coax. S1 in position 4	Level range switch S2 in pos.	Level T3 in position low distor.	Level T3 in position low noise	Atten-uation	Level T3 in position low distor.	Level T3 in position low noise	Atten-uation	Level T3 in position low distor.	Level T3 in position low noise	Gain	Level T3 in position low distor.	Level T3 in position low noise	Attenuation T3 in position low distor.	Attenuation T3 in position low noise
T3 in position low distortion			T3 in position low noise																
II	-	-	-	-	-	1	-	-	-	-	-	-	-70	-	10	-60	-	0	-
+20	0	-10	-	+20	+10	4	-10	+10	30	-40	-20	40	-80	-60	20	-60	-40	0	0
+10	-10	-20	-	+10	0	5	-20	0	30	-50	-30	0	-50	-30	10	-40	-20	20	20
0	-20	-30	+20	0	-10	6	-30	-10	30	-60	-40	0	-60	-40	20	-40	-20	20	20
-10	-30	-40	+10	-10	-20	7	-40	-20	30	-70	-50	0	-70	-50	10	-60	-40	0	0
-20	-40	-50	0	-20	-30	8	-50	-30	30	-80	-60	0	-80	-60	20	-60	-40	20	0
-30	-50	-60	-10	-30	-40	9	-60	-40	30	-90	-70	0	-90	-70	30	-60	-40	20	0
-40	-60	-70	-20	-40	-50	10	-70	-50	0	-70	-50	0	-70	-50	10	-60	-40	20	0
-50	-70	-80	-30	-50	-60	11	-80	-60	0	-80	-60	0	-80	-60	20	-60	-40	20	0
-60	-80	-90	-40	-60	-70	12	-90	-70	0	-90	-70	0	-90	-70	10	-80	-60	0	0
-70	-90	-100	-50	-70	-80	13	-100	-80	0	-100	-80	0	-100	-80	20	-80	-60	0	0
-80	-100	-110	-60	-80	-90	14	-110	-90	0	-110	-90	0	-110	-90	30	-80	-60	0	0
-90	-110	-120	-70	-90	-100	15	-120	-100	0	-120	-100	0	-120	-100	40	-80	-60	0	0
dbm							db												

Level T3 in position low distor.	Level T3 in position low noise	Gain	Level T3 in position low distor.	Level T3 in position low noise	Attenuation T3 in position low distor.	Attenuation T3 in position low noise	Level T3 in position low distor.	Level T3 in position low noise	Gain	Level T3 in position low distor.	Level T3 in position low noise	
-60	-	10	-50	-	20	-	-70	-	30	-40	-	
-60	-40	10	-50	-30	20	20	-70	-50	30	-40	-20	
-60	-40	10	-50	-30	20	20	-70	-50	30	-40	-20	
-60	-40	10	-50	-30	20	20	-70	-50	30	-40	-20	
-60	-40	10	-50	-30	20	20	-70	-50	30	-40	-20	
-80	-40	10	-70	-30	0	20	-70	-50	30	-40	-20	
-80	-40	10	-70	-30	0	20	-70	-50	30	-40	-20	
-80	-40	10	-70	-30	0	20	-70	-50	30	-40	-20	
-80	-40	10	-70	-30	0	20	-70	-50	30	-40	-20	
-80	-60	10	-70	-50	0	0	-70	-50	30	-40	-20	
-80	-60	10	-70	-50	0	0	-70	-50	30	-40	-20	
-80	-60	10	-70	-50	0	0	-70	-50	30	-40	-20	
-80	-60	10	-70	-50	0	0	-70	-50	30	-40	-20	
db												

FIG.8 LEVEL PLAN FOR THE "SELECTIV" MEASURING MODE, LEVEL METER Type Rel 3 D344a3a (DBM)

2. Checking the Level Steps

Check the level steps with an attenuator according to the measuring circuit (Fig. 9) and the statements in the tables (depending on the equipment model) 1, 2 or 3.

Permissible deviations: 0.2 db (0.02 N); the residual error of the attenuator ($\leq$ 0.5%) must be taken into account.

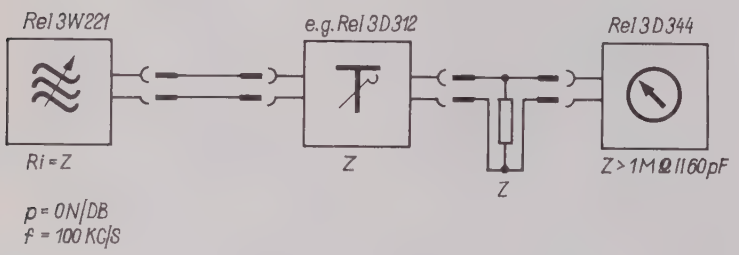


FIG.9 MEASURING CIRCUIT

3. Aligning the Level Steps

In the case of deviations from the nominal values, effect retuning with the correcting elements stated in the tables 1, 2 or 3.

To facilitate the finding of the correcting elements the related sub-assemblies are also stated in the tables.

No.	Attenuator a =	T1,T2	T3	Switch S2 Pos.	Indication	Setting of the Nominal with	Deflection in the Sub-assembly Rel
1	5 N	wide-band	low-distortion	9	-5 N	▼I	35 D 461a1a
2	6 N			10	-6 N	R64	35 D 458a1a
3	7 N			11	-7 N	R60	35 D 458a1a
4	8 N			17	-	R57	35 D 458a1a
5	3 N			7	-3 N	R51	35 D 458a1a
6	1 N			5	-1 N	C8	35 D 541a1a
7	3 N		low-noise	9	-3 N	R85	35 D 461a1a
8	6 N	selective		12	-6 N	▼II	35 D 461a1a
9	3 N			9	-3 N	C2	35 D 539a1a

Table 1 Level meter (N-model) Type Rel 3 D 344a1a

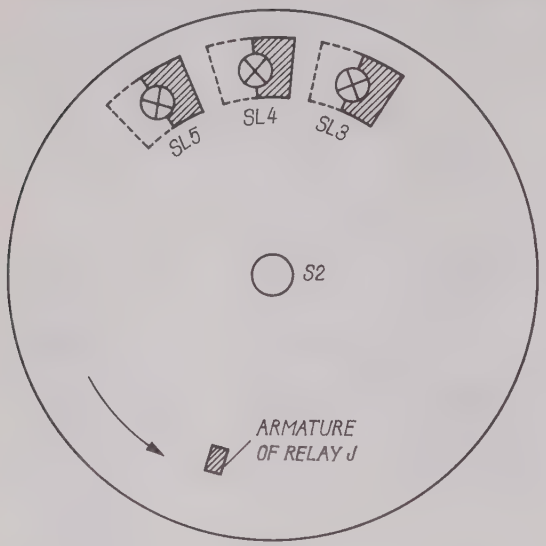
No.	Attenuator a =	T1, T2	T3	Switch S2 Pos.	Indication	Setting of the Nominal with	Deflection in the Sub-assembly Rel
1	40 db	wide-band	low-distor-tion	8	-40 db	▼I	35 D 461a2a
2	50 db			9	-50 db	R64	35 D 458a2a
3	60 db			10	-60 db	R60	35 D 458a2a
4	70 db			16	-	R57	35 D 458a2a
5	20 db			6	-20 db	R51	35 D 458a2a
6	0 db			4	0 db	C8	35 D 541a2a
7	20 db		low-noise	8	-20 db	R85	35 D 461a2a
8	50 db	selec-tive		11	-50 db	▼II	35 D 461a2a
9	20 db			8	-20 db	C2	35 D 539a2a

Table 2 Level meter (db-model) Type Rel 3 D 344a2a

No.	Attenuator a =	T1, T2	T3	Switch S2 Pos.	Indication	Setting of the Nominal with	Deflection in the Sub-assembly Rel
1	40 db	wide-band	low-distor-tion	7	-40 dbm	▼I	35 D 461a2a
2	50 db			8	-50 dbm	R64	35 D 458a3a
3	60 db			9	-60 dbm	R60	35 D 458a3a
4	70 db			15	-	R57	35 D 458a3a
5	20 db			5	-20 dbm	R51	35 D 458a3a
6	10 db			4	-10 dbm	C8	35 D 541a3a
7	20 db		low-noise	7	-20 dbm	R85	35 D 461a2a
8	50 db	selec-tive		10	-50 dbm	▼II	35 D 461a3a
9	20 db			7	-20 dbm	C2	35 D 539a3a

Table 3 Level meter (dbm-model) Type Rel 3 D 344a3a

4. Automatic Correction Unit (Koramat) of the Level Range Switch S2



The lamps in the "Koramat" automatic correction unit correctly indicate the measuring ranges set. The calibrating-settings ▼I, ▼II and the measuring attachment are indicated by lamp SL4.

FIG.10 LAMP ARRANGEMENT OF THE AUTOMATIC CORRECTION UNIT

a. Checking

In the case of wideband measurements the lamps stated below burn when the level range switch S2 of the db-models is in the positions 4 to ten, of the dbm-models in the positions 4 to 9, and of the N-models in the positions 4 to 11; in the case of selective measurements the following lamps burn in all positions of the level range switch.

SL3 in the case of balanced input and button position "low-noise"
SL4 in the case of balanced input and button position "low-distortion" and in the case of coaxial input and button position "low-noise"
SL5 in the case of coaxial input and button position "low-distortion"

In the level meter for power levels the armature of relay J rotates the disk with the three transparent scale windows by one detent position in the direction of the arrow (Fig. 10) for the high-impedance coaxial input (S1 in position 4) and the measuring attachment (S1 in position 11). A sensitivity increased by 10 dbm is thus indicated.

If the lamps are correctly switched by the automatic correction unit, the measuring range indication must agree with the tables in the circuit diagram "measuring field and preamplifier" Rel str 35 D 458a.

b. Fault Eliminating

In the case of a fault check first of all the lamps and then the wiring of the rotary switches $S1^{I}$, $S2^{I}$, the pushbuttons $T1^{IV}$ and $T2^{II}$, the turn-buttons $T3^{II, III, V}$ and the lamps SL3, 4, 5 for breaks by reference to Rel str 35 D 458a

C. Checking and Realigning the Frequency Calibration

1. Checking

Check the frequency calibration half an hour after energizing the device.

Connect the level oscillator to the level meter set for selective operation and connect a frequency counter across the level meter input for the frequency check.

Check the frequency calibration at some points of the range. The frequency calibration is in proper order when the error is less than $\pm 2 \times 10^{-3}$ ± 300 c/s.

2. Realigning

Check first of all the mechanical properies of the drive: When the drive is turned to its left stop, the first (unlettered) mark of the beginning end of the film must be above the reading mark in the scale window. If necessary, take out the film magazine and reinsert it as described in the section "Notes on Maintenance".

By shifting the film feedplate after loosening the two fastening screws (B) a residual fault can be offset to within ± 0.5 mm.

When the frequency is set to f_m = 1600 kc/s the variable oscillator unit G1 can then be readjusted to its nominal frequency of f_{o1} = 4000 kc/s with C2. To this end connect the frequency counter to the transformer output (terminals e2, e1) of the oscillator subassembly.

If the calibration is still not in order, check the oscillator units G1 to G3 (see section G.).

D. Input Balance

Checking

Calibrate the level meter in the "selective" setting (▼II) and set the impedance switch in the balanced range to Z > 10 kΩ (in the dbm-devices as referred to 600 Ω), interconnect the a- and b-wires of the balanced input and inject between the a/b and c-wires a signal of p = 0 db (N) at f = 600 kc/s with a level oscillator of Z ∼ 0 Ω.

Increase the sensitivity of the level meter with S2 until the meter deflection is well readable. The level indicated equals the residual common-mode suppression of the balanced input with sign reversed; nominal value ≥ 50 db (6 N).

Realigning

The residual balance can be maximized with L2, L3, and R68 in the input subassembly Type Rel 35 D 539a... (see circuit diagram of the measuring field and preamplifier Rel str 35 D 458a1a,2a,3a En).

E. Selectivity and Image Frequency Attenuation

1. Selectivity

a. Pass band width f_m ±30 c/s

Inject with the level oscillator (e.g. Type Rel 3 W 221) a level signal of 0 db (N), f_m = 100 kc/s, maximize the deflection with the frequency control on the level meter. Now vary the frequency by ±30 db with the fine control f_2 on the level oscillator (check with frequency counter). For the shape of the curve see page 1.16, Fig.13 of the Description.

b. Stop band attenuation f_m ±400 c/s

Inject a signal as stated under a, vary the transmitting frequency by +400 c/s and -400 c/s. Do not change the frequency tuning of the level meter, but increase the sensitivity with the level range switch S2 until the meter shows a well readable level. The stop band attenuation then equals the level difference; it must amount to ≥ 50 db (6 N).

If the values stated under a. and b. are not met, check the wiring of the 2-kc/s filter. Never adjust the coil cores.

2. Image Frequency Attenuation

a. For f_{sp1} (f_m +4.8 mc/s)

Before the measurement, calibrate the level meter in the "selective" setting and set the tuning control to f_m = 100 kc/s. Inject: f_{sp1} = 4.9 mc/s, p = 0 db (N), note impedance termination.

Increase the sensitivity with the level range switch S2 until the level meter shows a well readable deflection.

Demanded image frequency attenuation: $\geq$ 60 db (7 N)

If this value is not met, the fault will probably be caused by the 1.6-mc/s low-pass filter (1.62-mc/s low-pass filter subassembly Type Rel 35 D 542a). Check the ground soldering lugs for firm seat.

b. for f_{sp2} (f_m +144 kc/s)

Same settings on the level meter as stated under a.
Same signal injection as under a, but f_{sp2} = 244 kc/s.
Demanded image frequency attenuation: $\geq$ 80 db (9 N).

If this value is not met, check the circuit connections of the 2.4-kc/s filter (L6,7) in the amplifier and converter subassembly Type Rel 35 D 461a. If necessary realign the filter poles at 2256 kc/s. To this end inject via a 3-kΩ resistor a level signal of 0 db (N) with a frequency of exactly 2256 kc/s into the measuring jack M3 and then into M4. Connect a level meter with high-impedance input to M3 or M4 and minimize the reading on the level meter with L6, L7, nominal value -60 db (-7 N). After the alignment secure the coil cores again with lacquer.

c. for f_{sp3} (f_m +4[illegible] kc/s)

Same settings on the level meter as stated under a.
Signal injection as under a, but f_{sp3} = 104 kc/s.
Demanded image frequency attenuation: $\geq$ 80 db (9 N).

If this value is not met, check the circuit of the 72-kc/s filter (L8,L9) in the amplifier and converter subassembly Type Rel 35 D 461a.. . If necessary align the filter poles at 68 kc/s. To this end inject via a 3-kΩ resistor a level signal of 0 db (N) with a frequency of exactly 68 kc/s into the measuring jack M6 and then into M7. Connect a level meter with high-impedance input to M6 or M7 and minimize the reading on the level meter with L8, L9, nominal value -60 db (-7 N). After the alignment secure the coil cores again with lacquer.

3. Attenuation of the 1st Intermediate Frequency (IF_1 = 2.4 mc/s)

Inject a signal of p = 0 db (N), f = 2.4 mc/s; note impedance termination.

The frequency setting on the level meter is inconsequential. Rotate the level range switch S2 clockwise until the level meter shows a well readable deflection. The IF attenuation must amount to $\geq$ 80 db (9 N).

F. Residual Distortion Attenuation

Checking of the residual distortion attenuation is only possible when a low-distortion measuring voltage is available. The harmonics must be $\geq$ 100 db down, or else the measuring result is otherwise falsified.

Inject a low-distortion transmitting level of -20 db (-2 N) into the input of the level meter. Set the turnbutton T3 at the level meter to LOW DISTORTION. Measure the fundamental level; then tune the level meter first to the second harmonic of the transmitting frequency and then to third harmonic of the transmitting frequency and measure in each case the harmonic level (a_{k2}, a_{k3}). In this connection do not increase the sensitivity with the level range switch S2 by more than 60 db (7 N). The difference between the fundamental and the harmonic level (a_{k2} and a_{k3}) must be $\geq$ 80 db (9 N).

If the value measured is below this limit, check the tubes 1 and 2 and the modulator Md1. The forward resistances of all four crystal diodes must not differ by more than about 10%. If the modulator must be replaced, it is absolutely necessary to check the balanced condition of the modulator (see section A.2.b).

G. Checking the Oscillators

1. Oscillator Unit G1 (2.4 to 4.02 mc/s)

Connect the RF Multizet meter to point 2/1 (⊥) of strip e. When the film scale is rotated through its range, the oscillator voltage must be between 1.7 and 2.3 v. It can be set with C6. When the inner conductor of jack SYNCHR is connected to chassis (if available use shorting plug) the oscillator voltage must drop to zero; if it does not, check relay H.

2. Oscillator Unit G2 (2328 kc/s)

Check the oscillator by reference to the voltage and frequency data of the circuit diagram Rel str 3 D 344a. With C106 the oscillator frequency can be aligned to the nominal frequency.

3. Oscillator Unit G3 (70 kc/s)

Check the oscillator by reference to the voltage and frequency data of the circuit diagram Rel str 3 D 344a. Measure the -40-db (-5-N) calibrating voltage with a high-impedance level meter. At mains voltage variations of ±10% the calibrating voltage must not vary by more than ±1%. At greater deviations, measure the forward and the reverse resistance of the crystal diode Gr5 and check the Zener diode Gr6.

H. Measuring Attachment

1. Impedance Measurement

Effect calibrating as stated in the Instructions for Use and check the measuring ranges with standard resistors, for instance decade resistor Type Rel 3 B 41.

2. Measuring the Return Loss and the Common-mode Suppression

a. Checking

A resistor of 75 Ω +1% and one of 75 Ω -1% are used for checking. In the measuring position RETURN LOSS connect one resistor each to the jacks R_X and R_N between the a- and b-wires. In measuring position COMMON-MODE SUPPRESSION the test resistors are connected to jack R_X as shown in Fig.11. During either measurement the level meter must indicate -40 ±1 db (-4.6 ±0.1 N).

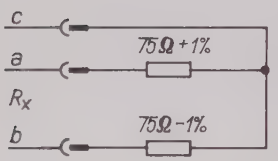


FIG.11 MEASURING CIRCUIT

b. Realigning

In case of major deviations align with C2 for maximum residual return loss in the position RETURN LOSS and with C1 for maximum residual common-mode suppression in position COMMON-MODE SUPPRESSION.

Maximum residual loss corresponds to minimum deflection on the level meter. During the alignment leave the jacks R_X and R_N unconnected.

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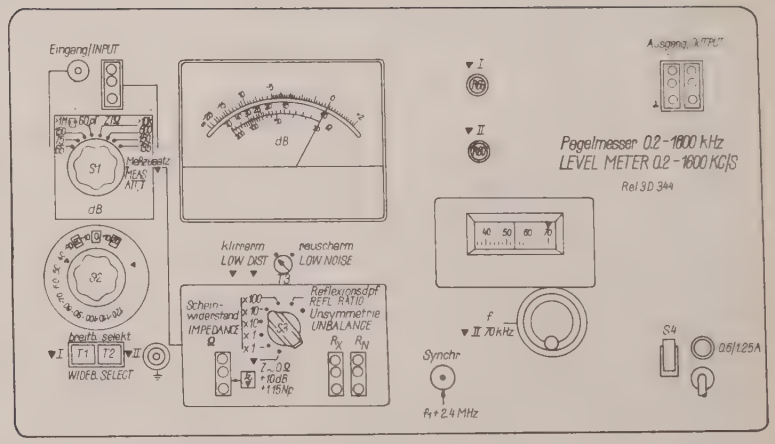
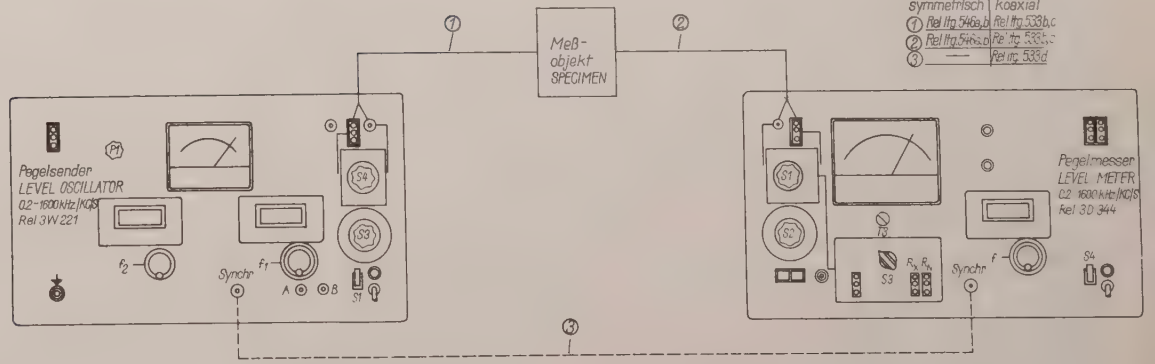


Frontansicht mit Bedienungselementen des Pegelmessers
PANEL VIEW WITH CONTROL ELEMENTS OF THE LEVEL METER



a. Breitbandige und selektive Pegel-, Dämpfungs- und Verstärkungs-Messungen
WIDEBAND AND SELECTIVE MEASUREMENTS OF LEVEL, ATTENUATION AND GAIN

b. Mit zusätzlicher Verbindung ③ selektive Messungen mit automatischer Abstimmung
WITH ADDITIONAL CONNECTION (3) SELECTIVE MEASUREMENTS WITH AUTOMATIC TUNING

Beispiele für Meßplatzaufbau
TYPICAL MEASURING SETUPS

Bildanlage 1
ANNEXED FIG. 1

gesamt 3 D 344

Vervielfältigung dieser Unterlage sowie Verwertung und Mitteilung ihres Inhaltes unzulässig, soweit nicht ausdrücklich zugestanden. Zuwiderhandlungen sind straf- bar und verpflichten zu Schadenersatz (LitUrhG, UWG, BGB). Alle Rechte für den Fall der Patenterteilung oder GM-Eintragung vorbehalten.
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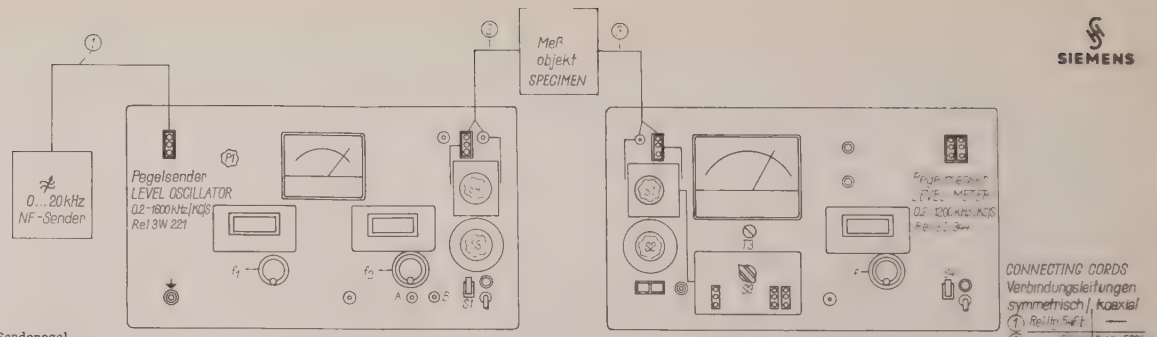
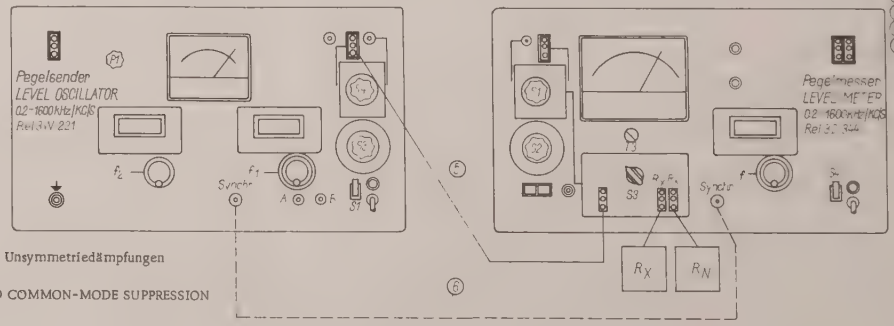
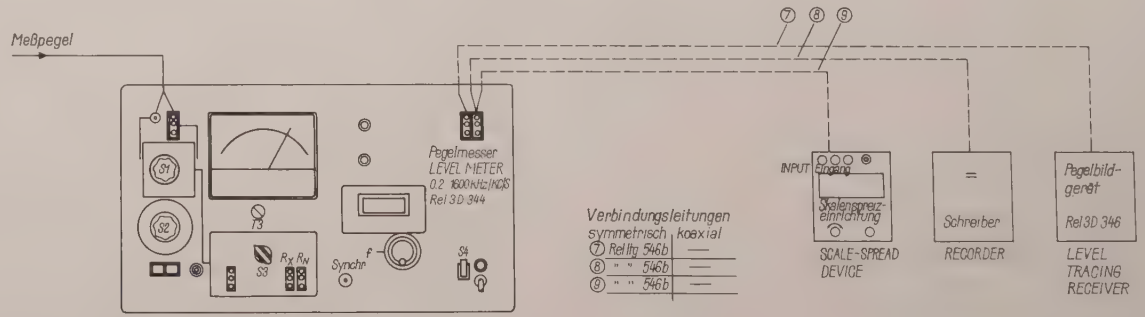

Meß objekt SPECIMEN
0...20 kHz NF-Sender
Pegelsender LEVEL OSCILLATOR 0,2-1600 kHz/KQS Rel 3 W 221
Pegelmesser LEVEL METER 0,2-1600 kHz/KQS Rel 3 D 344
CONNECTING CORDS
Verbindungsleitungen
symmetrisch / koaxial
① Rel/ltg 546 b —
② " " 546 b Rel/ltg 533 b
③ " " 546 b " " 533 b
④ " " 546 b —
⑤ " " 546 b —
⑥ — Rel/ltg 533 d

a. Messungen mit amplitudenmoduliertem Sendepegel
MEASUREMENTS WITH AMPLITUDE-MODULATED TRANSMITTING LEVEL



b. Messungen von Scheinwiderständen, Fehlerdämpfungen und Unsymmetriedämpfungen sowie Reflexionsdämpfungen
MEASUREMENTS OF IMPEDANCES, RETURN LOSSES, AND COMMON-MODE SUPPRESSION (BALANCE) RATIOS AS WELL AS REFLECTION RATIOS



c. Anschluß von Zusatzeinrichtungen am Pegelmesser
(Skalenspreizeinrichtung Rel 3 B 942, Schreiber und Pegelbildgerät Rel 3 D 346)
CONNECTION OF ATTACHMENTS TO THE LEVEL METER
(SCALE-SPREAD DEVICE Type Rel 3 B 942, RECORDER AND LEVEL TRACING RECEIVER Type Rel 3 D 346)

Beispiele für Meßplatzaufbau
TYPICAL MEASURING SETUPS

Bildanlage 2
ANNEXED FIG. 2

gesamt 3 D 344

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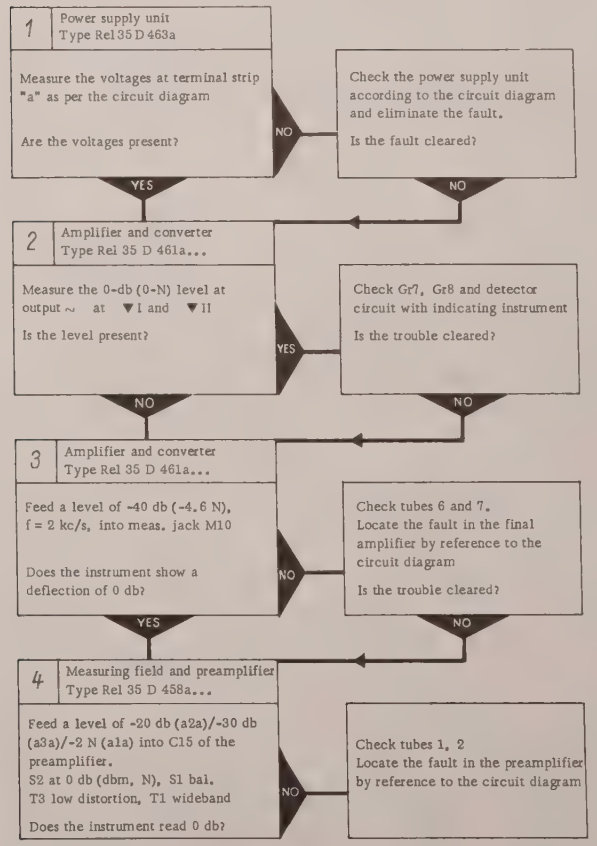
Settings:
Controls " ▼I" and " ▼II" in mid-position.
Frequency tuning control at 70 kc/s

For the measuring and connecting points see Rel str 3 D 344a... and Rel str 35 D 458a...
as well as the photos in the Parts List part


1
Power supply unit
Type Rel 35 D 463a
Measure the voltages at terminal strip "a" as per the circuit diagram
Are the voltages present?
NO
Check the power supply unit according to the circuit diagram and eliminate the fault.
Is the fault cleared?
YES
NO
2
Amplifier and converter
Type Rel 35 D 461a...
Measure the 0-db (0-N) level at output ~ at ▼I and ▼II
Is the level present?
YES
Check Gr7, Gr8 and detector circuit with indicating instrument
Is the trouble cleared?
NO
NO
3
Amplifier and converter
Type Rel 35 D 461a...
Feed a level of -40 db (-4.6 N), f = 2 kc/s, into meas. jack M10
Does the instrument show a deflection of 0 db?
NO
Check tubes 6 and 7.
Locate the fault in the final amplifier by reference to the circuit diagram
Is the trouble cleared?
YES
NO
4
Measuring field and preamplifier
Type Rel 35 D 458a...
Feed a level of -20 db (a2a)/-30 db (a3a)/-2 N (a1a) into C15 of the preamplifier.
S2 at 0 db (dbm, N), S1 bal.
T3 low distortion, T1 wideband
Does the instrument read 0 db?
NO
Check tubes 1, 2
Locate the fault in the preamplifier by reference to the circuit diagram

FAULT LOCATING IN THE LEVEL METER:
CALIBRATING I (▼I) AND II (▼II), WIDEBAND AND SELECTIVE MEASUREMENTS ARE IMPOSSIBLE

ANNEXED FIG.3

gesamt 3 D 344

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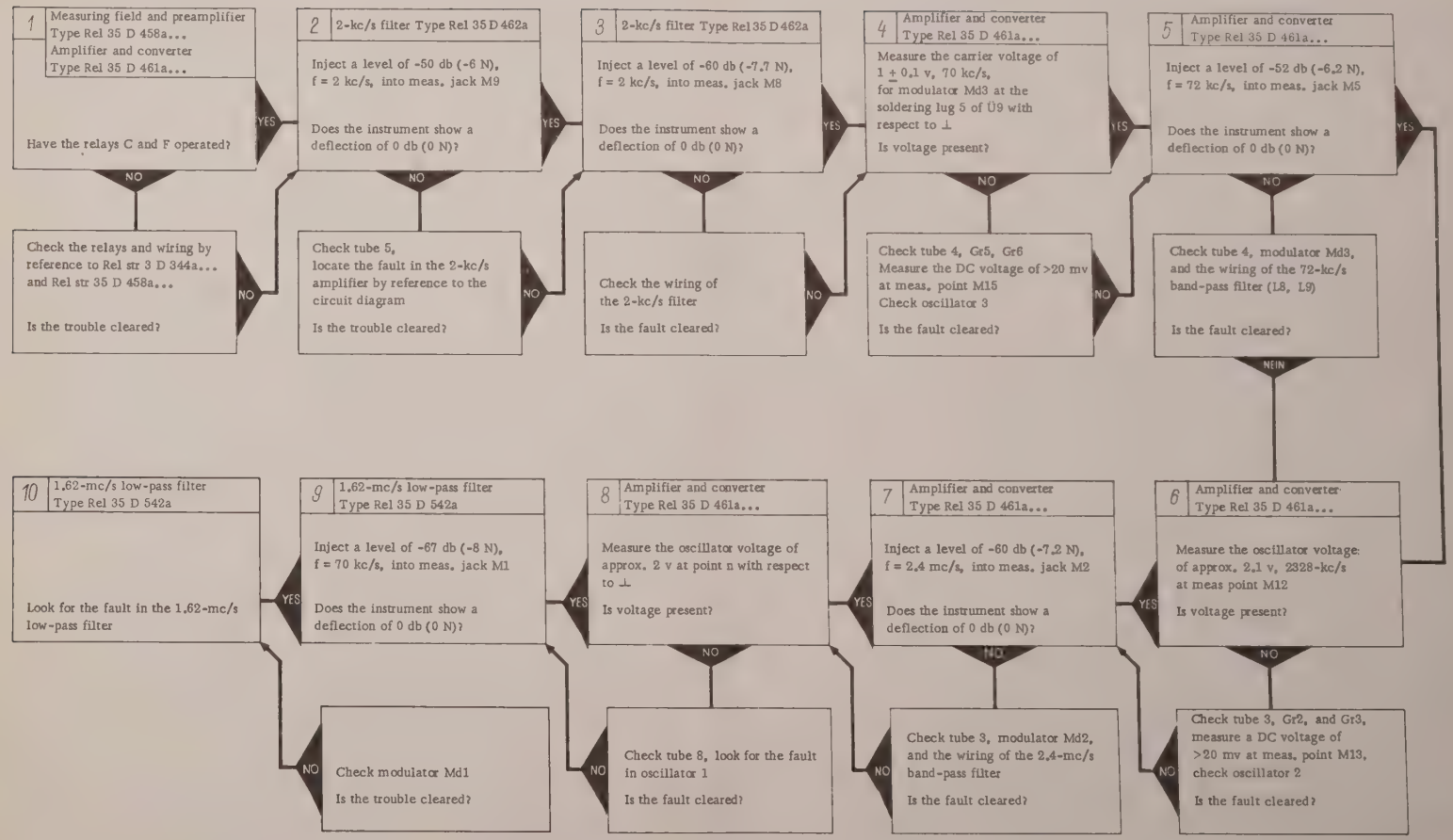
Settings:

Press T2 selective
▼II (R60) in mid-position — T3 low distortion
Frequency tuning control at 70 kc/s — S2 0 db

For the measuring and connecting points see Rel str 3 D 344a...,
Rel str 35 W 458a..., and photos in the Parts List part


1 Measuring field and preamplifier Type Rel 35 D 458a... Amplifier and converter Type Rel 35 D 461a...
Have the relays C and F operated?
YES
NO
Check the relays and wiring by reference to Rel str 3 D 344a... and Rel str 35 D 458a...
Is the trouble cleared?
NO
2 2-kc/s filter Type Rel 35 D 462a
Inject a level of -50 db (-6 N), f = 2 kc/s, into meas. jack M9
Does the instrument show a deflection of 0 db (0 N)?
YES
NO
Check tube 5, locate the fault in the 2-kc/s amplifier by reference to the circuit diagram
Is the trouble cleared?
NO
3 2-kc/s filter Type Rel 35 D 462a
Inject a level of -60 db (-7,7 N), f = 2 kc/s, into meas. jack M8
Does the instrument show a deflection of 0 db (0 N)?
YES
NO
Check the wiring of the 2-kc/s filter
Is the fault cleared?
NO
4 Amplifier and converter Type Rel 35 D 461a...
Measure the carrier voltage of 1 ± 0,1 v, 70 kc/s, for modulator Md3 at the soldering lug 5 of Ü9 with respect to ⊥
Is voltage present?
YES
NO
Check tube 4, Gr5, Gr6 Measure the DC voltage of >20 mv at meas. point M15 Check oscillator 3
Is the fault cleared?
NO
5 Amplifier and converter Type Rel 35 D 461a...
Inject a level of -52 db (-6,2 N), f = 72 kc/s, into meas. jack M5
Does the instrument show a deflection of 0 db (0 N)?
YES
NO
Check tube 4, modulator Md3, and the wiring of the 72-kc/s band-pass filter (L8, L9)
Is the fault cleared?
NEIN
6 Amplifier and converter Type Rel 35 D 461a...
Measure the oscillator voltage of approx. 2,1 v, 2328-kc/s at meas point M12
Is voltage present?
YES
NO
Check tube 3, Gr2, and Gr3, measure a DC voltage of >20 mv at meas. point M13, check oscillator 2
Is the fault cleared?
NO
7 Amplifier and converter Type Rel 35 D 461a...
Inject a level of -60 db (-7,2 N), f = 2,4 mc/s, into meas. jack M2
Does the instrument show a deflection of 0 db (0 N)?
YES
NO
Check tube 3, modulator Md2, and the wiring of the 2,4-mc/s band-pass filter
Is the fault cleared?
NO
8 Amplifier and converter Type Rel 35 D 461a...
Measure the oscillator voltage of approx. 2 v at point n with respect to ⊥
Is voltage present?
YES
NO
Check tube 8, look for the fault in oscillator 1
Is the fault cleared?
NO
9 1,62-mc/s low-pass filter Type Rel 35 D 542a
Inject a level of -67 db (-8 N), f = 70 kc/s, into meas. jack M1
Does the instrument show a deflection of 0 db (0 N)?
YES
NO
Check modulator Md1
Is the trouble cleared?
NO
10 1,62-mc/s low-pass filter Type Rel 35 D 542a
Look for the fault in the 1,62-mc/s low-pass filter

FAULT LOCATING IN THE LEVEL METER:
SELECTIVE MEASUREMENTS AND ▼ II
ARE NOT POSSIBLE

ANNEXED FIG. 4

gesamt 3 D 344

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Meßfeld und Vorverstärker Rel 35 D 458a1a,2a,3a 6.3
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Z SWITCH S1

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MEAS RANGE SWITCH S2

Meßzusatz Rel 35 D 459a1a,2a 6.12
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OSCILLATOR 1

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COIL CAN

Verstärker und Umsetzer Rel 35 D 461a1a,2a 6.17
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2-KC/S FILTER

1,62-MHz-Tiefpaß Rel 35 D 542a 6.26
1.62-MC/S LOW-PASS FILTER

Netzteil Rel 35 D 463a 6.29
POWER SUPPLY UNIT

Montageschaltbilder WIRING DIAGRAMS

Pegelmesser . . . . . Rel ms 3 D 344a
LEVEL METER

Meßfeld und Vorverstärker . . . Rel ms 35 D 458a1a,a2a,a3a
MEAS FIELD AND PREAMPLIFIER

Eingangsbaugruppe . . . . . Rel ms 35 D 539a1a,a2a,a3a
INPUT SUBASSEMBLY

Z-Schalter S1 . . . . . Rel ms 35 D 540a1a,a2a,a3a
Z SWITCH S1

Meßbereichschalter S2 . . . . . Rel ms 35 D 541a1a,a2a,a3a
MEAS RANGE SWITCH S2

Meßzusatz . . . . . Rel ms 35 D 459a1a,a2a
MEAS ATTACHMENT

Oszillator 1 . . . . . Rel ms 35 D 460a
OSCILLATOR 1

Spulentopf . . . . . Rel ms 35 D 464a
COIL CAN

Verstärker und Umsetzer . . . . Rel ms 35 D 461a
AMPLIFIER AND CONVERTER

2-kHz-Filter . . . . . Rel ms 35 D 462a
2-KC/S FILTER

1,62-MHz-Tiefpaß . . . . . Rel ms 35 D 542a
1.62-MC/S LOW-PASS FILTER

Netzteil . . . . . Rel ms 35 D 463a
POWER SUPPLY UNIT

Schaltbilder CIRCUIT DIAGRAMS

Pegelmesser . . . . . Rel str 3 D 344a1a, 2a, 3a
LEVEL METER

Meßfeld und Vorverstärker . . . Rel str 35 D 458a1a,a2a,a3a
MEAS FIELD AND PREAMPLIFIER

Vorbemerkung zur Stückliste

Unter Symbol stehen die in den Stromläufen verwendeten Abkürzungen für die Bauteile in alphabetischer und - soweit möglich - in numerischer Reihenfolge. Mit Stück ist die Anzahl der gleichen Bauteile innerhalb der Geräte oder der Baugruppen bezeichnet. In der Spalte Gegenstand sind außer dem Namen des Bauteils auch seine Hauptkennwerte angegeben. Mit der Bestellangabe ist das Bauteil durch einen Abkürzungs-Code oder eine Bauvorschrift eindeutig gekennzeichnet.

Es bedeuten:

bei einem Widerstand:	300 kΩ ±5%; 0,5 W
300 kΩ	Nennwert des Widerstandes
±5%	Toleranz des Nennwiderstandes
0,5 W	Belastbarkeit bezogen auf Umgebungstemperatur 20°C
bei einem Kondensator:	1000 pF ±20%; 125 V-
1000 pF	Nennwert der Kapazität (1 pF = 1 µµF = 10^{-12} F)
±20%	Toleranz der Nennkapazität
125 V-	Zulässige Betriebsgleichspannung

bei einem Übertrager:	Wicklg.I (1a,2a,3a)	Wicklg.II (rtsw,gesw, rtgn,gegnsw)+
	440 Wdg 0,1 CuL 75 Ω	720 Wdg HFL SS 60x0,03 35 Ω
	228 µH ±2%	1.Abgriff(gesw): 46 Wdg
	Abgriff(2a):210 Wdg	2.Abgriff(rtgn):190 Wdg

Wicklg. I (1a,2a,3a)	
440 Wdg	440 Windungen, Anfang Lötöse 1a, Ende 3a;
0,1 CuL	aus Kupferdraht (Cu); 0,1 mm Ø; lackisoliert (L)
75 Ω	Gleichstromwiderstand der Wicklung I
L = 228 µH	Induktivität
Abgriff(2a): 210 Wdg	Abgriff bei der 210. Windung, Lötöse 2a
Wicklg.II	sinngemäß wie bei Wicklung I
HFS SS 60x0,03 . . .	Hochfrequenzlitze 2fach seidenumsponnen (SS), aus Kupferdraht 60x0,03 mm Ø

+ Farbkurzzeichen

bl = blau	ge = gelb	gr = grau	sw = schwarz	rs = rosa
br = braun	gr = grün	rt = rot	ws = weiß	rtsw = rot/schwarz

bei einem Gleichrichter: 50 V / 250 mA

50 V	Anschluß-Wechselspannung
250 mA	entnehmbarer Betriebsstrom

bei Halbleitern:

J_D	Durchlaßstrom bei +1 V	Dioden
U_{Sp}	Sperrspannung	Dioden
J_Z	Zenerstrom	Zenerdioden
U_Z	Zenerspannung	Zenerdioden
r_Z	Dynamischer Zener-Widerstand bei J_Z	Zenerdioden
R_{20}	Widerstand bei 20°C z.B. von Heißleitern	
T_K	Temperaturkoeffizient	

Introductory remark to the parts list

The "SYMBOL" column shows the abbreviations used in the circuit diagrams in alphabetic and, to the extent possible, numerical order. "QTY" denotes the number of identical components within the devices or the subassembly. The "DESCRIPTION" column gives, apart from the designation of the component its principal characteristic data. The "ORDERING DATA" column designates the component nonambiguously by an abbreviation code or component specification.

There denotes, for instance

with a resistor: 300 kΩ ±5% 0,5 W

300 kΩ	Nominal value of the resistance
±5%	Tolerance of the nominal resistance
0,5 W	Wattage rating, as referred to an ambient temperature of 20°C

with capacitor: 1000 pF ±20% 125 V-

1000 pF	Nominal value of the capacitante (1 pF = 1 µµF = 10^{-12} F)
±20%	Tolerance of the nominal capacitance
125 V-	Permissible DC operating voltage

with a transformer:

Wicklg.I(1a,2a.3a)	Wicklg.II (rtsw,gesw,rtgn,gegnsw)+
440 Wdg 0,1 CuL 75 Ω	720 Wdg HFL SS 60x0,03 35 Ω
228 µH ±2%	1. Abgriff (gesw): 46 Wdg
Abgriff(2a): 210 Wdg	2. Abgriff (rtgn):190 Wdg

Wicklg. I(1a,2a,3a)

440 Wdg	440 turns, start soldering lug 1a, end 3a
0,1 CuL	of copper wire (Cu); 0.1 mm dia., enamelled (L)
75 Ω	DC resistance of winding I
228 µH	Inductance
Abgriff(2a):210 Wdg	Tap at soldering lug 2a at the 210th turn
Wicklg. II . . .	Analogously to winding I
HFL SS 60x0,03 .	RF copper Litz wire, with double silk covering, 60x0.03 mm dia.

with a rectifier: 50 V/250 mA

50 V	Primary AC voltage
250 mA	Available operating current

+ Color symbols

bl = blue	ge = yellow	gr = grey	sw = black	rs = pink
br = brown	gn = green	rt = red	ws = white	rtsw = red/black

with semiconductors:

J_D	Forward current with +1 v	Diodes
U_{Sp}	Inverse voltage	
J_Z	Zener current	Zener diodes
U_Z	Zener voltage	
r_Z	Dynamic Zener resistance at J_Z	
R_{20}	Resistance at 20°C, e.g., of thermistors	
TK	Temperature coefficient	

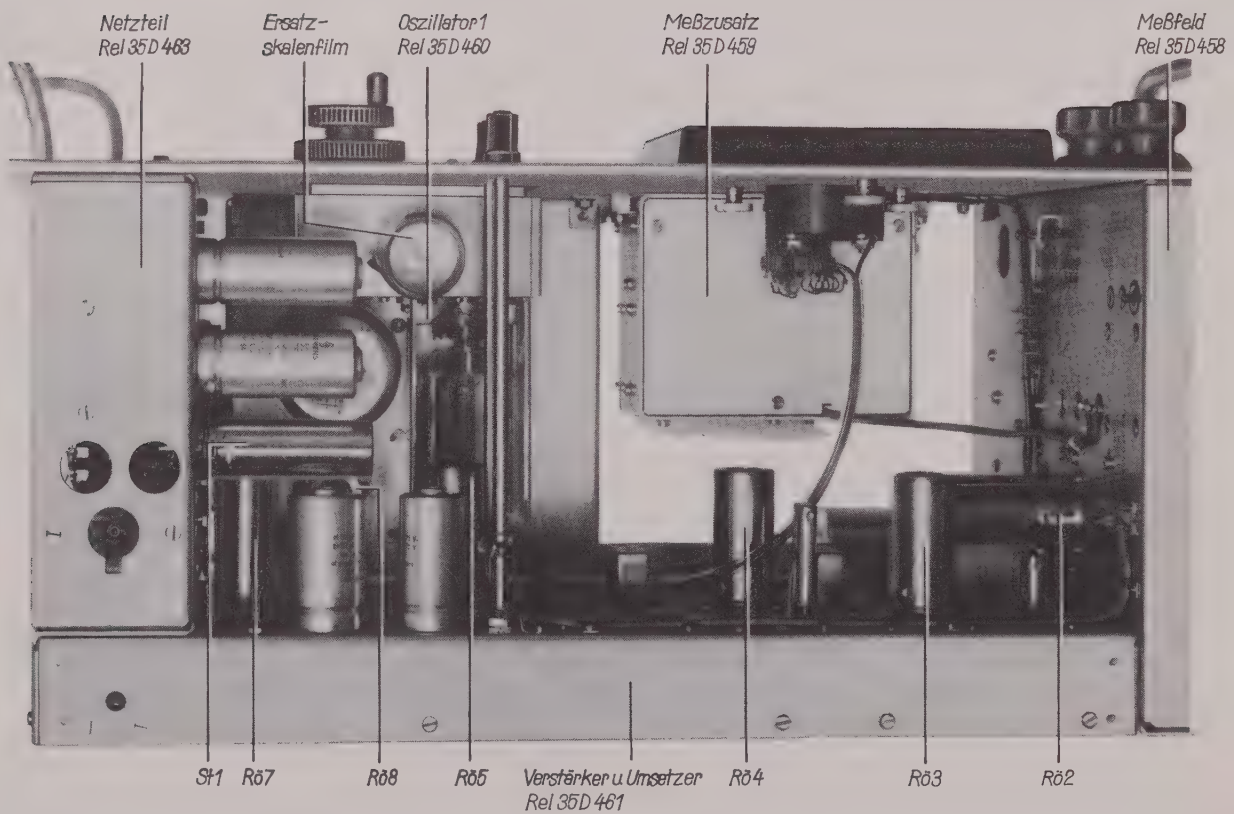


Bild 1 Pegelmesser Rel 3 D 344a
FIG. 1 LEVEL METER

Symbol SYMBOL	Stck QTY	Gegenstand DESCRIPTION	Bestellangabe ORDERING DATA	Seite PAGE
		Meßfeld und Vorverstärker MEAS FIELD AND PREAMPLIFIER		
		für Ausführung Rel 3 D 344a 1a FOR MODEL		
	1		Rel 35 D 458a1a	6.3
		für Ausführung Rel 3 D 344a 2a FOR MODEL		
	1		Rel 35 D 458a2a	
		für Ausführung Rel 3 D 344a 3a FOR MODEL		
	1		Rel 35 D 458a3a	
		Meßzusatz MEAS ATTACHMENT		
		für Ausführung Rel 3 D 344a 1a FOR MODEL		
	1		Rel 35 D 459a1a	6.12
		für Ausführung Rel 3 D 344a 2a,3a FOR MODEL		
	1		Rel 35 D 459a2a	
		Oszillator 1 OSCILLATOR 1		
		für Ausführung Rel 3 D 344a 1a-3a FOR MODEL		
	1		Rel 35 D 460a	6.14
		Verstärker und Umsetzer AMPLIFIER AND MODULATOR		
		für Ausführung Rel 3 D 344a 1a FOR MODEL		
	1		Rel 35 D 461a1a	6.17
		für Ausführung Rel 3 D 344a 2a,3a FOR MODEL		
	1		Rel 35 D 461a2a	
		Netzteil POWER SUPPLY UNIT		
		für Ausführung Rel 3 D 344a 1a-3a FOR MODEL		
	1		Rel 35 D 463a	6.29

J	1	Drehspul-Instrument MOVING-COIL INSTRUMENT 40µA ±1,5%; 3000Ω -30/+20% Äußerer Schließungswiderstand: 50kΩ EXTERNAL RESISTANCE	Ms sdr 578 Bv 1 Pos.1
SL 1	3	Signallampe INDICATING LAMP 6V / 0,1A	Fg lp 62 bc (C30230-Z62-A53)
St 1	1	Stabilisator STABILIZER TUBE	108 C 1 (Fa.Valvo)
Tr	1	Leuchtdrehtaste LUMINOUS TURNKEY	Fg sch 346c Fg Bv 67c 260x, 622A727
		Instrumenten-Anschlußleitung INSTRUMENT CONNECTING CORD	
	1	rot/RED } 500mm lang/	Rel Bv 657 D 1613
	1	blau/BLUE } LENTH 500 MM	Rel Bv 657 D 1614
	1	Netz-Anschlußleitung POWER CORD	Rel ltg 702e

Eingangsbaugruppe
INPUT SUBASSEMBLY

für Ausführung Rel 35 D 458a 1a FOR MODEL		
1	Rel 35 D 539a1a	6.8
für Ausführung Rel 35 D 458a 2a FOR MODEL		
1	Rel 35 D 539a2a	
für Ausführung Rel 35 D 458a 3a FOR MODEL		
1	Rel 35 D 539a3a	

Meßbereichschalter S2
MEAS RANGE SWITCH S2

für Ausführung Rel 34 D 458a 1a FOR MODEL		
1	Rel 35 D 541a1a	6.11
für Ausführung Rel 35 D 458a 2a FOR MODEL		
1	Rel 35 D 541a2a	
für Ausführung Rel 35 D 458a 3a FOR MODEL		
1	Rel 35 D 541a3a	

C 15,19	2	MKH-Kondensator MKH CAPACITOR 0,01µF ±20%; 300V-	B32220-A3103-M
C 16	1	Elektrolyt-Kondensator ELECTROLYTIC CAPACITOR 25µF +50/-20%; 35V-	B41931-A7256-S
C 17	1	Keramik-Kondensator CERAMIC CAPACITOR 10pF ±0,5pF; 500V-	B 38215 N150 A 10 D
		MKL-Kondensator MKL CAPACITOR	
C 18	1	2,2µF ±20%; 50V-	B32110-C9225-M
C 20,31	2	0,068µF ±20%; 300V-	B32220-A3683-M
C 25	1	Elektrolyt-Kondensator ELECTROLYTIC CAPACITOR 50µF +50/-20%; 35V-	B41931-A7506-S

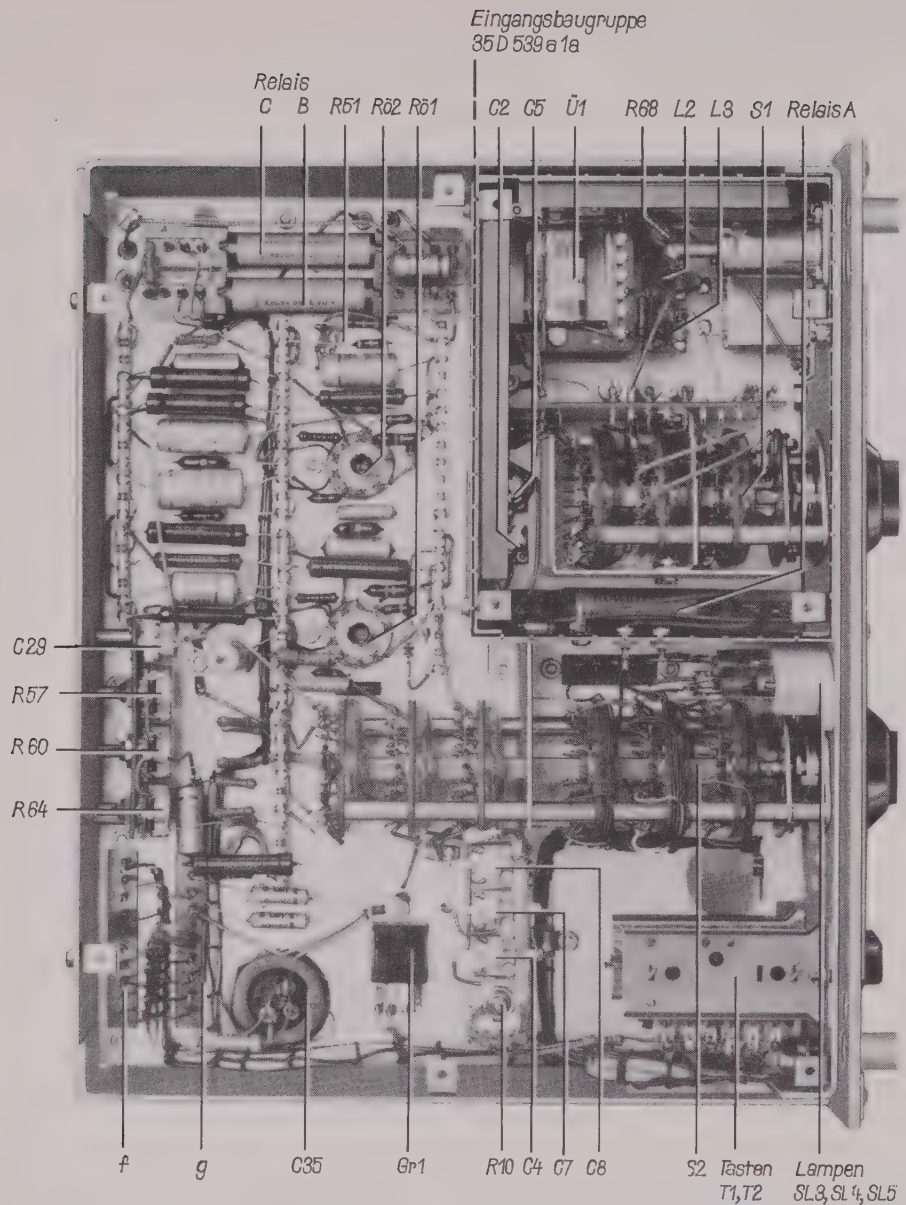


Bild 2 Meßfeld und Vorverstärker Rel 35 D 458a
FIG. 2 MEAS FIELD AND PREAMPLIFIER

C 26/35	1	Elektrolyt-Kondensator ELECTROLYTIC CAPACITOR 32+32µF +50/-10%; 350V-	B43731-A4646-T
C 27,33,34	3	MKH-Kondensator MKH CAPACITOR 0,15µF ±20%; 50V-	B32110-C9154-M
C 28	1	Elektrolyt-Kondensator ELECTROLYTIC CAPACITOR 10µF +50/-20%; 100V-	B41931-A9106-S
C 29	1	Lufttrimmer AIR-DIELECTRIC TRIMMER 1,3-5pF +15%; 250V-	Rel ko 131c
C 30	1	Elektrolyt-Kondensator ELECTROLYTIC CAPACITOR 10µF +50/-20%; 100V-	B41931-A9106-S
C 32	1	MKH-Kondensator MKH CAPACITOR 0,1µF ±20%; 300V-	B32220-A3104-M
C 36	1	MKL-Kondensator MKL CAPACITOR 0,33µF ±20%; 100V-	B32110-C0334-M
Gr 1	1	Flachgleichrichter FLAT-TYPE RECTIFIER 30V / 250mA	V23201-F1208 (B 30 C 250)
L 1	1	UKW-Drossel VHF REACTOR 40µH; 0,2A; 4150mΩ	B82501-A-C7
		Schichtwiderstand LAYER-TYPE RESISTOR	
R 12	1	1,5kΩ ±1%; 0,1W	B 51263 A 1,5 K 1/0,5
R 17 21,31,41	4	50Ω ±5%; 0,2W	B 51362 A 50 Ω 5/2
R 18	1	3kΩ ±1%; 0,15W	B 51264 A 3 K 1/0,5
R 20	1	10kΩ ±5%; 1W	B 51266 A 10 K 5/2
R 22, 42	2	10kΩ ±5%; 0,33W	B 51363 A 10 K 5/2
R 23,35	2	8kΩ ±5%; 1W	B 51266 A 8 K 5/2
R 24,32,36	3	2kΩ ±5%; 0,33W	B 51363 A 2 K 5/2
R 25,46	2	200Ω ±5%; 0,25W	B 51263 A 200 Ω 5/2
R 30	1	50kΩ ±5%; 0,25W	B 51263 A 50 K 5/2
R 33	1	100kΩ ±5%; 0,25W	B 51263 A 100 K 5/2
R 34	1	500Ω ±5%; 0,5W	B 51265 A 500 Ω 5/2
R 43	1	4kΩ ±5%; 1W	B 51266 A 4 K 5/2
R 44	1	2kΩ ±5%; 0,5W	B 51265 A 2 K 5/2

		Schichtwiderstand LAYER-TYPE RESISTOR	
R 45	1	4kΩ ±1%; 0,1W	B 51263 A 4 K 1/0,5
R 47	1	500Ω ±5%; 1W	B 51266 A 500 Ω 5/2
R 49	1	15Ω ±5%; 0,25W	B 51263 A 15 Ω 5/2
R 50	1	40Ω ±5%; 0,2W	B 51362 A 40 Ω 5/2
R 65	1	390Ω ±5%; 0,25W	B 51263 A 390 Ω 5/2
		Schicht-Drehwiderstand LAYER-TYPE VAR RESISTOR	
R 51	1	100Ω +20/-30%; 0,1W	100 Ω lin Rel wd 165a
R 57,60	2	100Ω +20/-30%; 0,1W	100 Ω lin Rel wd 165b
R 64	1	500Ω +20/-30%; 0,1W	500 Ω lin Rel wd 165h
		Schichtwiderstand LAYER-TYPE RESISTOR	
		für Ausführung Rel 35 D 458a 1a FOR MODEL	
R 16	1	7MΩ ±5%; 0,5W	B 51265 A 7 M 5/2 R
R 19	1	15kΩ ±1%; 0,1W	B 51263 A 15 K 1/0,5
R 48	1	2,2kΩ ±1%; 0,1W	B 51263 A 2,2 K 1/0,5
R 52	1	330Ω ±1%; 0,1W	B 51263 A 330 Ω 1/0,5
R 56,58	2	120Ω ±1%; 0,1W	B 51263 A 120 Ω 1/0,5
R 59	1	280Ω ±1%; 0,1W	B 51263 A 280 Ω 1/0,5
R 61	1	750Ω ±1%; 0,1W	B 51263 A 750 Ω 1/0,5
R 62	1	3kΩ ±1%; 0,1 W	B 51263 A 3 K 1/0,5
R 63	1	1kΩ ±1%; 0,1W	B 51263 A 1 K 1/0,5
		für Ausführung Rel 35 D 458a 2a,3a FOR MODEL	
R 16	1	5MΩ ±5%; 0,5W	B 51265 A 5 M 5/2 R
R 19,48	2	3kΩ ±1%; 0,1W	B 51263 A 3 K 1/0,5
R 52	1	320Ω ±1%; 0,1W	B 51263 A 320 Ω 1/0,5
R 58	1	40Ω ±1%; 0,15W	B 51264 A 40 Ω 1/0,5
R 59	1	240Ω ±1%; 0,1W	B 51263 A 240 Ω 1/0,5
R 61	1	190Ω ±1%; 0,1W	B 51263 A 190 Ω 1/0,5
R 62,63	2	900Ω ±1%; 0,1W	B 51263 A 900 Ω 1/0,5
R 56	1	60Ω ±1%; 0,1W	B 51263 A 60 Ω 1/0,5
SL 3-5	3	Signallampe INDICATING LAMP 6V / 0,1A	Fg lp 62 bc
T 1/2	1	Drucktastenschalter PUSHBUTTON SWITCH	C42315-Z7-C3(Fa.Schadew,Bln) 2xUX17,5 J 4u1a(Fa.Schwarz)

		Lötstiftleiste SOLDERING-PIN STRIP	
	1	5polig / 5-POLE	Rel ale 55ad
	2	10polig / 10-POLE	Rel ale 55ai
B,C	2	SG-Relais DRY-REED RELAY Wicklg. I (3,4) 6700 Wdg 0,07 CuL 880Ω	Rel Bv 662 E 31
		für Ausführung Rel 35 D 458a 3a FOR MODEL	
J	1	Kleines Rundrelais MIDGET ROUND RELAY 3600 Wdg 0,15 CuL 120Ω ±10%	T rls 6a T Bv 62012/9c T kfs 9c Lochreihe II

Eingangsbaugruppe Rel 35 D 539a 1a,2a,3a (Ausgabe II)
INPUT SUBASSEMBLY (ISSUE II)

Z-Schalter S1
Z SWITCH S1

für Ausführung Rel 35 D 539a 1a
FOR MODEL

1 Rel 35 D 540a1a

für Ausführung Rel 35 D 539a 2a
FOR MODEL

1 Rel 35 D 540a2a

für Ausführung Rel 35 D 539a 3a
FOR MODEL

1 Rel 35 D 540a3a

6.10

C 2,5	2	Lufttrimmer AIR-DIELECTRIC TRIMMER 1,9-11pF +15%; 250V-	Rel ko 131d
		Kf-Kondensator PLASTIC-FOIL CAPACITOR	
		für Ausführung Rel 35 D 539a 1a FOR MODEL	
C 3	1	32pF ±1%; 125V-	B31140-A1320-F
C 6	1	750pF ±1%; 125V-	B31140-A1751-F
C 12	1	...+pF ±2%; 125V-	B31140-A1...-G
		für Ausführung Rel 35 D 539a 2a,3a FOR MODEL	
C 3	1	25pF ±1%; 125V-	B31140-A1250-F
C 6	1	1000pF ±1%; 125V-	B31140-A1102-F
C 12	1	...+pF ±5%; 125V-	B31140-A1...-G

+Wert wie eingebaut / VALUE AS MOUNTED

L 2,3	2	HF-Spule RF COIL Wicklg. I (1,2) 55 Wdg 0,35 CuL 0,21Ω 10µH ±10%	Rel Bv 623 M 3054
		Schichtwiderstand LAYER-TYPE RESISTOR	
R 13	1	20Ω ±5%; 0,25W	B 51263 A 20 Ω 5/2
R 69	1	12Ω ±5%; 0,25W	B 51263 A 12 Ω 5/2
R 68	1	Draht-Drehwiderstand WIRE-WOUND VAR RESISTOR 25Ω ±5%; 1W	25Ω ±5% C42408-Z9-C2 (Fa.Rosenthal)

		Schichtwiderstand LAYER-TYPE RESISTOR	
		für Ausführung Rel 35 D 539a 1a FOR MODEL	
R 5	1	250Ω ±1%; 0,1W	B 51263 A 250 Ω 1/0,5
		für Ausführung Rel 35 D 539a 2a FOR MODEL	
R 5	1	300Ω ±1%; 0,1W	B 51263 A 300 Ω 1/0,5
		für Ausführung Rel 35 D 539a 3a FOR MODEL	
R 5	1	3kΩ ±1%; 0,1W	B 51263 A 3 K 1/0,5
R 70	1	100Ω ±1%; 0,1W	B 51263 A 100 Ω 1/0,5
		Eingangsübertrager INPUT TRANSFORMER	
		für Ausführung Rel 35 D 539a 1a FOR MODEL	
Ü 1	1	Wicklg. I (1a,7a) 38 Wdg 330,15 CuL paral.0,9Ω Wicklg. II (1b,7b) 280 Wdg 0,06 CuL 140Ω 2,7H	Rel Bv 621 E 3260
		für Ausführung Rel 35 D 539a 2a,3a FOR MODEL	
Ü 1	1	Wicklg. I (1a,7a) 28 Wdg 3x0,22 CuL paral.0,3Ω Wicklg. II (1b,7b) 280 Wdg 0,06 CuL 140Ω 2,7H	Rel Bv 621 E 3257
	1	Buchseneinheit JACK ASSEMBLY 2polig / 2-POLE	Rel kli 6a
	1	HF-Steckerbuchse COAXIAL JACK	Rel send 129, Tz 46
A	1	SG-Relais DRY-REED RELAY Wicklg. I (2,3) 6700 Wdg 0,07 CuL 880Ω	Rel Bv 662 E 39

Z-Schalter S1 Rel 35 D 540a 1a,2a,3a (Ausgabe II/III)
Z-SWITCH S1 (ISSUE II/III)

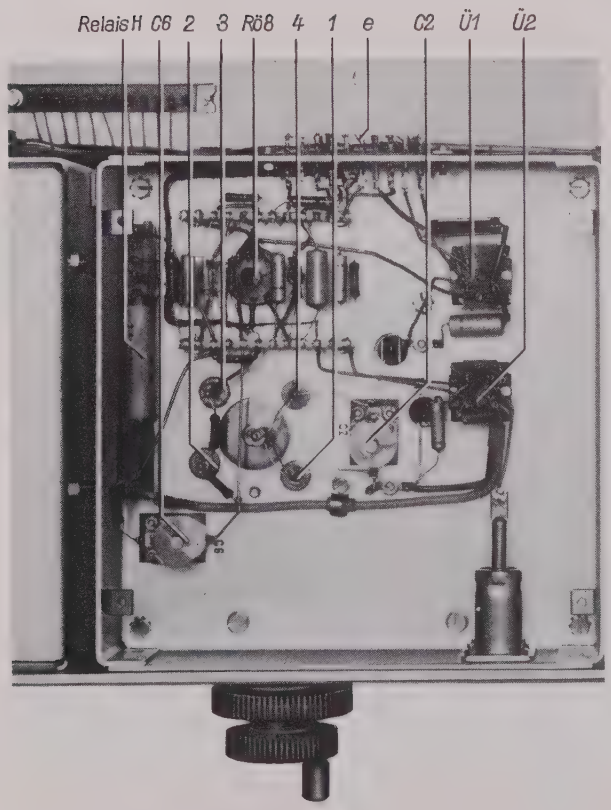
S 1	1	Drehschalter ROTARY SWITCH	C44315-A12-A8
		Schichtwiderstand LAYER-TYPE RESISTOR	
R 4	1	600Ω ±1%; 0,15W	B 51264 A 600 Ω 1/0,5
		für Ausführung Rel 35 D 540a 1a FOR MODEL	
R 3,6	2	150Ω ±1%; 0,25W	B 51265 A 150 Ω 1/0,5
R 7	1	75Ω ±1%; 0,5W	B 51266 A 75 Ω 1/0,5
R 8	1	65Ω ±1%; 0,5W	B 51266 A 65 Ω 1/0,5
		für Ausführung Rel 35 D 540a 2a FOR MODEL	
R 1	1	140Ω ±1%; 0,25W	B 51265 A 140 Ω 1/0,5
R 2	1	4kΩ ±1%; 0,1W	B 51263 A 4 K 1/0,5
R 3,6,7',7	4	150Ω ±1%; 0,5W	B 51266 A 150 Ω 1/0,5
R 8,8'	2	130Ω ±1%; 0,5W	B 51266 A 130 Ω 1/0,5
		für Ausführung Rel 35 D 540a 3a FOR MODEL	
R 1	1	135Ω ±1%; 0,15W	B 51264 A 135 Ω 1/0,5
R 2,14	2	1,69kΩ ±1%; 0,1W	B 51263 A 1,69 K 1/0,5
R 3	1	150Ω ±1%; 0,15W	B 51264 A 150 Ω 1/0,5
R 6	1	178Ω ±1%; 0,15W	B 51264 A 178 Ω 1/0,5
R 7	1	157Ω ±1%; 0,15W	B 51264 A 157 Ω 1/0,5
R 8	1	81,5Ω ±1%; 0,15W	B 51264 A 81,5 Ω 1/0,5
R 15,26	2	2,1kΩ ±1%; 0,1W	B 51263 A 2,1 K 1/0,5
R 71	1	192Ω ±1%; 0,1W	B 51263 A 192 Ω 1/0,5
R 72	1	9,3Ω ±1%; 0,15W	B 51264 A 9,3 Ω 1/0,5
R 73	1	20,7Ω ±1%; 0,15W	B 51264 A 20,7 Ω 1/0,5
R 74,75	2	300Ω ±1%; 0,1W	B 51263 A 300 Ω 1/0,5
R 76	1	27Ω ±1%; 0,15W	B 51264 A 27 Ω 1/0,5
R 77	1	100Ω ±1%; 0,1W	B 51263 A 100 Ω 1/0,5

C 4,7,8	3	Lufttrimmer AIR-DIELECTRIC TRIMMER 1,3-5pF +15%; 250V-	Rel ko 131c
	für Ausfg./FOR MODEL Rel 35 D 541a 1a		
		Kf-Kondensator PLASTIC-FOIL CAPACITOR	
C 9	1	16pF ±1pF; 125V-	B31140-A1160-A
C 10	1	1000pF ±1%; 125V-	B31140-A1102-F
C 11	1	...+pF ±1pF; 125V-	B31140-A1...-A
C 13	1	Keramik-Kondensator CERAMIC CAPACITOR ...+pF ±0,25pF; 500V-	B 38215 N075 A...C
	für Ausfg./FOR MODEL Rel 35 D 541a 2a,3a		
		Kf-Kondensator PLASTIC-FOIL CAPACITOR	
C 9	1	9pF ±1pF; 125V-	B31140-A1090-A
C 10	1	1250pF ±1%; 125V-	B31140-A1122-F500
C 11	1	...+pF ±1%; 125V-	B31140-A1...-F
C 13	1	Keramik-Kondensator CERAMIC CAPACITOR ...+pF ±2%; 500V-	B 38215 N075 A...C
	für Ausfg./FOR MODEL Rel 35 D 541a 1a,2a,3a		
R 9	1	Schichtwiderstand LAYER-TYPE RESISTOR 15Ω ±5%; 0,25W	B 51263 A 15 Ω 5/2
R 10	1	Schicht-Drehwiderstand LAYER-TYPE VAR RESISTOR 100Ω +20/-30%; 0,1W	100 Ω lin Rel wd 165b
		Schichtwiderstand LAYER-TYPE RESISTOR	
	für Ausfg./FOR MODEL Rel 35 D 541a 1a		
R 11	1	80Ω ±1%; 0,1W	B 51263 A 80 Ω 1/0,5
	für Ausfg./FOR MODEL Rel 35 D 541a 2a,3a		
R 11	1	50Ω ±1%; 0,1W	B 51263 A 50 Ω 1/0,5
S 2	1	Drehschalter ROTARY SWITCH	C44315-A12-A9

+ Wert wie eingebaut
VALUE AS MOUNTED

			Lufttrimmer AIR-DIELECTRIC TRIMMER	
C	1	1	2,1-13pF +15%; 250V-	Rel ko 131i
C	2	1	1,3-5pF +15%; 250V-	Rel ko 131c
C	6	1	3,5-54pF +15%; 250V-	Rel ko 130d
			Keramik-Kondensator CERAMIC CAPACITOR	
C	3	1	4pF ±0,25pF; 500V-	B 38215 N150 A 4 C
C	5	1	2pF ±0,25pF; 500V-	B 38215 N033 A 2 C
		für Ausfg./FOR MODEL Rel 35 D 459a 1a		
C	4	1	5pF ±0,5pF; 500V-	B 38215 N150 A 5 D
			Schichtwiderstand LAYER-TYPE RESISTOR	
		für Ausfg./FOR MODEL Rel 35 D 459a 1a,2a		
R	1-3	3	10Ω ±1%; 0,15W	B 51264 A 10 Ω 1/0,5
R	4,7	2	...kΩ ±1%; 0,1W Wert wie eingebaut VALUE AS MOUNTED	B 51263 A ... K 1/0,5
		für Ausfg./FOR MODEL Rel 35 D 459a 1a		
R	5	1	45Ω ±1%; 0,15W	B 51264 A 45 Ω 1/0,5
R	6	1	25Ω ±1%; 0,15W	B 51264 A 25 Ω 1/0,5
R	8	1	500Ω ±5%; 0,25W	B 51263 A 500 Ω 5/2
S	3	2	Bereichschalter RANGE SWITCH 2 Ebenen / 2-DECK	Rel sch 301b, Form A
		für Ausfg./FOR MODEL Rel 35 D 459a 2a		
R	8	1	Schichtwiderstand LAYER-TYPE RESISTOR 400Ω ±5%; 0,25W	B 51263 A 400 Ω 5/2
		für Ausfg./FOR MODEL Rel 35 D 459a 1a,2a		
			Übertrager TRANSFORMER	
Ü	1	1	Wicklg. I/II(1a,7a)(1a,7a) 60 Wdg 0,35 CuL 1/1,1Ω I ‖ II = 83mH Wicklg. IIa,IIb(1b,6b)(2b,7b) 11 Wdg 3x0,45 CuL paral.0,06Ω	Rel Bv 621 E 3258
Ü	2	1	Wicklg. I/V(1a,3a)(1a,3a) 70 Wdg 0,13 CuL 2,5/2,7Ω	Rel Bv 621 C 3059

Ü 2 Forts./CONT'D		Wicklg. II (4b,1b) 1 Wdg 0,05 Cu-Folie Wicklg. III(gesw,gert,gegn) 9 Wdg 3x0,34 CuL paral.0,02Ω Wicklg. IV (4a,2a) 20 Wdg 2x0,24 CuL paral.0,11Ω II+III+IV+I ‖ V =80mH	
	für Ausfg./FOR MODEL Rel 35 D 459a 1a		
Ü 3	1	Wicklg. I (-,7a) 51 Wdg 2x0,18 CuL paral.1,2Ω Wicklg. II (1b,7b) 218 Wdg 0,08 CuL 60Ω 1,6H	Rel Bv 621 E 3261
	für Ausfg./FOR MODEL Rel 35 D 459a 2a		
Ü 3	1	Wicklg. I (-,7a) 38 Wdg 2x0,25 CuL paral.0,9Ω Wicklg. II (1b,7b) 220 Wdg 0,08 CuL 60Ω 1,6H	Rel Bv 621 E 3259



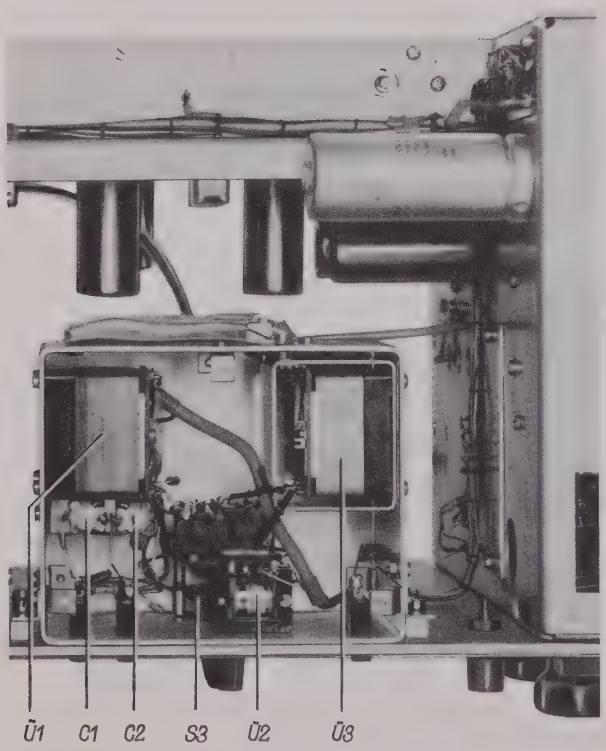
Oszillator1 Rel35D460a

Bild 3 Meßzusatz Rel 35 D 459a
FIG.3 MEAS ATTACHMENT

Oszillator 1 Rel 35 D 460a (Ausgabe III)
OSCILLATOR 1 (ISSUE III)

	1	Spulentopf COIL CAN	Rel 35 D 464a	6.16
C 1	1	Keramik-Kondensator CERAMIC CAPACITOR ...pF ±0,5pF; 500V- Wert wie eingebaut VALUE AS MOUNTED	B 38215 N750 A ... D	
		Lufttrimmer AIR-DIELECTRIC TRIMMER		
C 2	1	2-31pF +15%; 250V-	Rel ko 130b	
C 6	1	3,5-54pF +15%; 250V-	Rel ko 130d	
C 7	1	Kf-Kondensator PLASTIC-FOIL CAPACITOR 40pF ±5%; 125V-	B31140-A1400-J	
C 8,12	2	MKH-Kondensator MKH CAPACITOR 0,1µF ±20%; 300V-	B32220-A3104-M	
C 9,11 13,14	4	MKL-Kondensator MKL CAPACITOR 0,1µF ±20%; 100V-	B32110-C0104-M	
		Kf-Kondensator PLASTIC-FOIL CAPACITOR		
C 10	1	1000pF ±5%; 125V-	B31140-A1102-J	
C 15	1	25pF ±5%; 125V-	B31140-A1250-J	
K 1	1	Luft-Drehkondensator AIR-DIELECTRIC VAR CAPACITOR 15-250pF ±10%; 350V-	C42208-Z8-C24 (C 001 DB/250E Fa.Valvo)	
		Schichtwiderstand LAYER-TYPE RESISTOR		
R 1,15	2	200kΩ ±5%; 0,25W	B 51263 A 200 K 5/2	
R 2,6	2	100Ω ±5%; 0,15W	B 51262 A 100 Ω 5/2	
R 3	1	100Ω ±5%; 0,25W	B 51263 A 100 Ω 5/2	
R 4,5	2	5kΩ ±5%; 0,25W	B 51263 A 5 K 5/2	
R 7	1	2,5kΩ ±5%; 0,33W	B 51264 A 2,5 K 5/2	
R 8	1	100kΩ ±5%; 0,25W	B 51263 A 100 K 5/2	
R 9	1	50kΩ ±5%; 0,25W	B 51263 A 50 K 5/2	
R 10	1	4kΩ ±5%; 0,5W	B 51265 A 4 K 5/2	
R 11	1	3kΩ ±5%; 0,25W	B 51263 A 3 K 5/2	
R 12	1	20kΩ ±5%; 0,25W	B 51263 A 20 K 5/2	
R 13	1	600Ω ±1%; 0,1W	B 51263 A 600 Ω 1/0,5	

			Schalenkernspule POT-CORE COIL	
Ü 1		1	Wicklg. I (3,4) 8 Wdg 2x0,42 CuL paral.0,024Ω Wicklg. II (1,2) 27 Wdg 0,28 CuL 0,36Ω	Rel Bv 622 N 3431
Ü 2		1	Wicklg. I (1,3) 31 Wdg 0,25 CuL 0,4Ω Wicklg. II (4,6) 11 Wdg 0,25 CuL 0,13Ω	Rel Bv 622 N 3511
		1	HF-Steckerbuchse COAXIAL JACK	Rel kli 110a
		1	Lötstiftleiste SOLDERING-PIN STRIP 10polig / 10-POLE	Rel ale 55ai
H		1	SG-Relais DRY-REED RELAY Wicklg. I (3,4) 6700 Wdg 0,07 CuL 880Ω	Rel Bv 662 E 31



Meßzusatz Rel 35D 459a

Bild 4 Oszillator 1 Rel 35 D 460a
FIG. 4 OSCILLATOR 1

Spulentopf 1 Rel 35 D 464a (Ausgabe I)
COIL CAN 1 (ISSUE I)

C 3	1	Keramik-Kondensator CERAMIC CAPACITOR 100pF ±20%; 500V-	B 38223 NPO F 100 G
		Kf-Kondensator PLASTIC-FOIL CAPACITOR	
C 4	1	950pF ±2%; 500V-	B31142-A5951-G
C 5	1	650pF ±2%; 500V-	B31142-A5651-G
L 1	1	HF-Oszillatorspule RF OSCILLATOR COIL Wicklg. I (1,7) 40 Wdg HFL S 90x0,04 0,4Ω 11,5µH ±1,7%	Rel Bv 623 G 3054

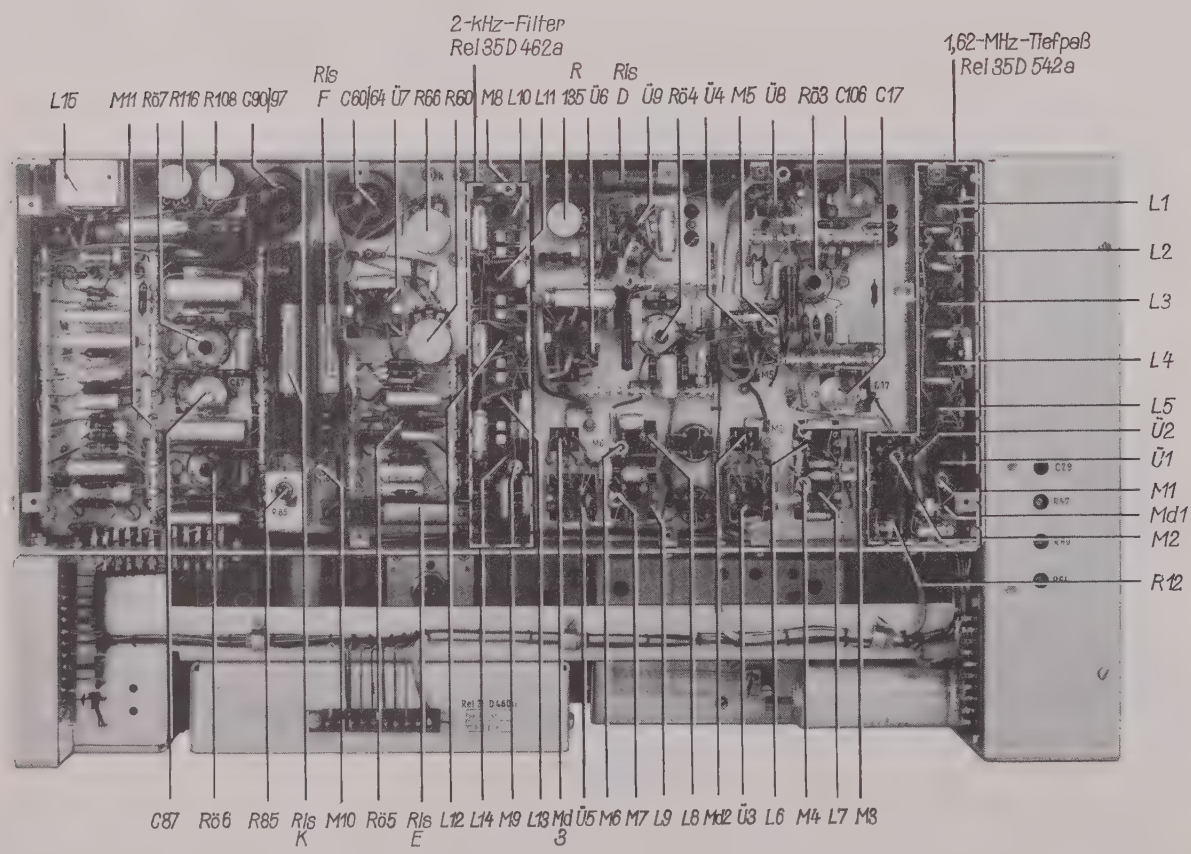

2-kHz-Filter
Rel 35 D 462a
1,62-MHz-Tiefpaß
Rel 35 D 542a
L15 M11 Rö7 R116 R108 C90/97 Rls F C60/64 Ü7 R66 R60 M8 L10 L11 R 135 Ü6 D Rls Ü9 Rö4 Ü4 M5 Ü8 Rö3 C106 C17
L1
L2
L3
L4
L5
Ü2
Ü1
M1
Md1
M2
R12
C87 Rö6 R85 Rls K M10 Rö5 Rls E L12 L14 M9 L13 Md 3 Ü5 M6 M7 L9 L8 Md2 Ü3 L6 M4 L7 M3

Bild 5 Verstärker und Umsetzer Rel 35 D 461a
FIG. 5 AMPLIFIER AND CONVERTER

	1	2-kHz-Filter 2-KC/S FILTER	Rel 35 D 462a	6.24
	1	1,62-MHz-Tiefpaß 1.62-MC/S LOW-PASS FILTER	Rel 35 D 542a	6.26
C 16	1	Kf-Kondensator PLASTIC-FOIL CAPACITOR 15pF ±10%; 125V-	B31140-A1150-K	
C 17 106	2	Lufttrimmer AIR-DIELECTRIC TRIMMER 1,7-19pF +15%; 250V-	Rel ko 130a	
		MKH-Kondensator MKH CAPACITOR		
C 18 52,53,62 80,84 108,111,112	9	0,01µF ±20%; 300V-	B32220-A3103-M	
C 19 110	2	0,022µF ±20%; 300V-	B32220-A3223-M	
		Kf-Kondensator PLASTIC-FOIL CAPACITOR		
C 20	1	900pF ±1%; 125V-	B31140-A1901-F	
C 21,24	2	126pF ±1%; 125V-	B31140-A1121-F600	
C 22	1	99pF ±1%; 125V-	B31140-A1990-F	
C 23	1	822pF ±1%; 125V-	B31140-A1821-F200	
C 25	1	17pF ±1%; 125V-	B31140-A1170-F	
C 26	1	122pF ±1%; 125V-	B31140-A1121-F200	
C 31	1	700pF ±1%; 125V-	B31140-A1701-F	
C 32,71 116,117,127	5	MKL-Kondensator MKL CAPACITOR 0,15µF ±20%; 50V-	B32110-C9154-M	
C 33 95,121	3	MKH-Kondensator MKH CAPACITOR 0,1µF ±20%; 300V-	B32220-A3104-M	
		Kf-Kondensator PLASTIC-FOIL CAPACITOR		
C 34	1	23970pF ±0,5%; 125V-	B31051-A1233-D970	
C 35,38	2	3235pF ±1%; 125V-	B31140-A1322-F350	
C 36	1	3435pF ±1%; 125V-	B31140-A1342-F350	

		Kf-Kondensator PLASTIC-FOIL CAPACITOR	
C 37	1	23800pF ±0,5%; 125V-	B31051-A1233-D800
C 39	1	169pF ±1%; 125V-	B31140-A1161-F900
C 40	1	320pF ±1%; 125V-	B31140-A1321-F
C 44,101	2	0,02µF ±1%; 125V-	B31140-A1203-F
C 54,89	2	MKL-Kondensator MKL CAPACITOR 1µF ±20%; 50V-	B32110-C9105-M
		Elektrolyt-Kondensator ELECTROLYTIC CAPACITOR	
C 59 63,85	3	10µF +50/-20%; 35V-	B41951-A7106-S
C 60/64	1	16+16µF +50/-10%; 250V-	B43731-A2326-T
C 61	1	MKH-Kondensator MKH CAPACITOR 0,22µF ±20%; 250V-	B32229-A2224-M
		Kf-Kondensator PLASTIC-FOIL CAPACITOR	
C 65	1	3850pF ±1%; 125V-	B31140-A1382-F500
C 70	1	1000pF ±1%; 125V-	B31140-A1102-F
C 72	1	Elektrolyt-Kondensator ELECTROLYTIC CAPACITOR 50µF +50/-20%; 35V-	B41931-A7506-S
C 73	1	Keramik-Kondensator CERAMIC CAPACITOR 40pF ±5%; 500V-	B 38223 N150 D 40 J
		MKL-Kondensator MKL CAPACITOR	
C 74	1	0,33µF ±20%; 250V-	B32229-A2334-M
C 75	1	2,2µF ±20%; 250V-	B32110-C2225-M
C 76	1	Kf-Kondensator PLASTIC-FOIL CAPACITOR 6000pF ±5%; 250V-	B31142-A2602-J
C 81,96	2	Elektrolyt-Kondensator ELECTROLYTIC CAPACITOR 25µF +50/-20%; 35V-	B41931-A7256-S
		MKH-Kondensator MKH CAPACITOR	
C 82,99	2	1µF ±20%; 250V-	B32229-A2105-M
C 86	1	0,47µF ±20%; 250V-	
C 87	1	Keramik-Scheibentrimmer CERAMIC DISC-TYPE TRIMMER 10-60pF +70/-10%; 350V-	Rel ko 140ah

		Keramik-Kondensator CERAMIC CAPACITOR	
C 83	1	...$^{+}$pF ±0,25pF; 500V-	B 38215 P100 A ... C
C 88	1	32pF ±5%; 500V-	B 38212 N150 A 32 J
		Elektrolyt-Kondensator ELECTROLYTIC CAPACITOR	
C 90/97	1	32+32µF +50/-10%; 250V-	B43731-A2646-T
C 98	1	1µF +50/-10%; 250V-	B43711-A2105-T
C 100	1	MKL-Kondensator MKL CAPACITOR 2,2µF ±20%; 50V-	B32110-C9225-M
C 102	1	MKH-Kondensator MKH CAPACITOR 0,033µF ±20%; 300V-	B32220-A3333-M
C 107	1	Keramik-Kondensator CERAMIC CAPACITOR 15pF ±5%; 500V-	B 38218 N150 A 15 J
		Kf-Kondensator PLASTIC-FOIL CAPACITOR	
C 109	1	800pF ±2%; 125V-	B31140-A1801-G
C 118	1	...$^{+}$pF ±1%; 125V-	B31140-A1...-F
C 120	1	0,01µF ±1%; 125V-	B31142-A1103-F

$^{+}$ Wert wie eingebaut/VALUE AS MOUNTED

Gr 2	1	Richtleiter CRYSTAL DIODE J_D=6mA; U_{Sp}=30V	OA 159 (Fa.Telefunken)
Gr 3	1	Silizium-Zenerdiode SILICON ZENER DIODE J_Z=5mA; r_Z=4Ω; U_Z=8V	SZ 8 KB
Gr 5	1	Richtleiter CRYSTAL DIODE J_D=130mA; U_{Sp}=100V	OA 5 (Fa.Valvo)
Gr 6	1	Silizium-Zenerdiode SILICON ZENER DIODE J_Z=20mA; r_Z=1,2Ω; U_Z=7V	SZ 7 KB
Gr 7,8	2	Richtleiter CRYSTAL DIODE J_D=6mA; U_{Sp}=30V	OA 159 (Fa.Telefunken)
		Schwingquarz CONTROL CRYSTAL	
Kr 1	1	2328 kHz / KC/S	Rel Bv 673 W 131
Kr 2	1	70	Rel Bv 673 A 8

		Schalenkernspule POT-CORE COIL	
L 6,7	2	Wicklg. I (4,3) 38 Wdg HFL S 60x0,04 0,37Ω	Rel Bv 622 N 3512
L 8,9	2	Wicklg. I (4,3) 124 Wdg 0,25 CuL 1,8Ω 169mH ±2%	Rel Bv 622 N 3514
L 15	1	Wicklg. I (1,2,3) 718 Wdg 0,13 CuL 52Ω Abgriff (2): 210 Wdg 318mH ±2%	Rel Bv 622 P 3299
Md 2,3	2	Steckmodulator PLUG-IN MODULATOR 4xOA90	Rel Bv 672 R 165
		Schichtwiderstand LAYER-TYPE RESISTOR	
R 16,44,77	3	400kΩ ±5%; 0,25W	B 51263 A 400 K 5/2
R 17,121	2	400Ω ±5%; 0,2W	B 51263 A 400 Ω 5/2
R 18,20 31,33,58 76,102,130	8	3kΩ ±5%; 0,33W	B 51363 A 3 K 5/2
R 19,32,38 39-41	6	300Ω ±1%; 0,1W	B 51263 A 300 Ω 1/0,5
R 25-28	4	1kΩ ±1%; 0,1W	B 51263 A 1 K 1/0,5
R 29,45,54 73,101,123 126,133	8	100kΩ ±5%; 0,2W	B 51362 A 100 K 5/2
R 30 50,56,131	4	100Ω ±5%; 0,2W	B 51362 A 100 Ω 5/2
R 43	1	250kΩ ±5%; 0,25W	B 51263 A 250 K 5/2
R 48	1	400Ω ±5%; 0,2W	B 51362 A 400 Ω 5/2
R 49	1	Thernewid THERNEWID THERMISTOR R_{20}=50Ω ±5%; TK - 3,5%/°C	K 11c 50Ω 3,5
		Schichtwiderstand LAYER-TYPE RESISTOR	
R 51	1	250Ω ±1%; 0,1W	B 51263 A 250 Ω 5/2
R 52 71,89	3	4kΩ ±5%; 0,33W	B 51363 A 4 K 5/2
R 53	1	10kΩ ±5%; 0,33W	B 51363 A 10 K 5/2
R 55	1	5kΩ ±1%; 0,1W	B 51263 A 5 K 5/2
R 57	1	1kΩ ±5%; 0,33W	B 51363 A 1 K 5/2
R 59,99	2	2kΩ ±5%; 0,33W	B 51363 A 2 K 5/2
R 61	1	120kΩ ±5%; 0,25W	B 51263 A 120 K 5/2

R 60	1	Schicht-Drehwiderstand LAYER-TYPE VAR RESISTOR 100kΩ +20/-30%; 0,2W	100 K lin Rel wd 10d
	für Ausfg./FOR MODEL Rel 35 D 461a 2a		
R 65	1	Schichtwiderstand LAYER-TYPE RESISTOR 1kΩ ±1%; 0,1W	B 51263 A 1 K 1/0,5
	für Ausfg./FOR MODEL Rel 35 D 461a 1a,2a		
R 66	1	Schicht-Drehwiderstand LAYER-TYPE VAR RESISTOR 500Ω +20/-30%; 0,2W	500 Ω lin Rel wd 10d
		Schichtwiderstand LAYER-TYPE RESISTOR	
R 67	1	500Ω ±1%; 0,1W	B 51263 A 500 Ω 1/0,5
R 68,86	2	1MΩ ±5%; 0,33W	B 51264 A 1 M 5/2
R 69 75,87,98	4	50Ω ±5%; 0,2W	B 51362 A 50 Ω 5/2
R 70	1	100Ω ±1%; 0,1W	B 51263 A 100 Ω 1/0,5
R 72 95	2	8kΩ ±5%; 0,33W	B 51363 A 8 K 5/2
R 74	1	3kΩ ±1%; 0,1W	B 51263 A 3 K 1/0,5
R 78	1	6kΩ ±5%; 0,33W	B 51363 A 6 K 5/2
R 79	1	82kΩ ±5%; 0,33W	B 51363 A 82 K 5/2
R 83	1	8kΩ ±1%; 0,1W	B 51263 A 8 K 1/0,5
	für Ausfg./FOR MODEL Rel 35 D 461a 1a		
R 84	1	1,2kΩ ±1%; 0,1W	B 51263 A 1,2 K 1/0,5
	für Ausfg./FOR MODEL Rel 35 D 461a 2a		
R 84	1	850Ω ±1%; 0,1W	B 51263 A 850 Ω 1/0,5
	für Ausfg./FOR MODEL Rel 35 D 461a 1a,2a		
R 85	1	Schicht-Drehwiderstand LAYER-TYPE VAR RESISTOR 100Ω +20/-30%; 0,1W	100 Ω lin Rel wd 165a
		Schichtwiderstand LAYER-TYPE RESISTOR	
R 88	1	400Ω ±1%; 0,1W	B 51263 A 400 Ω 1/0,5
R 96	1	50kΩ ±5%; 0,2W	B 51362 A 50 K 5/2
R 97	1	10kΩ ±1%; 0,1W	B 51263 A 10 K 1/0,5
R 100	1	1,5kΩ ±5%; 0,5W	B 51265 A 1,5 K 5/2
R 103	1	4kΩ ±5%; 0,5W	B 51265 A 4 K 5/2
R 104	1	400Ω ±5%; 0,5W	B 51265 A 400 Ω 5/2
R 107	1	75kΩ ±1%; 0,1W	B 51263 A 75 K 1/0,5
R 108 116	2	Schicht-Drehwiderstand LAYER-TYPE VAR RESISTOR 10kΩ +20/-30%; 0,1W	10 K lin Rel wd 165a

		Schichtwiderstand LAYER-TYPE RESISTOR	
R 109	1	2,5kΩ ±1%; 0,1W	B 51263 A 2,5 K 1/0,5
R 110	1	4kΩ ±1%; 0,1W	B 51263 A 4 K 1/0,5
R 111	1	56kΩ ±1%; 0,1W	B 51263 A 56 K 1/0,5
R 112	1	2kΩ ±5%; 0,33W	B 51363 A 2 K 5/2
R 113	1	30kΩ ±1%; 0,1W	B 51263 A 30 K 1/0,5
R 114	1	22kΩ ±1%; 0,1W	B 51263 A 22 K 1/0,5
R 115	1	900Ω ±1%; 0,1W	B 51263 A 900 Ω 1/0,5
R 120	1	150Ω ±5%; 0,2W	B 51362 A 150 Ω 5/2
R 122	1	1kΩ ±5%; 0,25W	B 51263 A 1 K 5/2
R 124	1	6kΩ ±5%; 1W	B 51266 A 6 K 5/2
R 125 138	2	10Ω ±5%; 0,25W	B 51263 A 10 Ω 5/2
R 132	1	10kΩ ±5%; 0,25W	B 51263 A 10 K 5/2
R 134	1	25Ω ±2%; 0,25W	B 51263 A 25 Ω 2/2
R 135	1	Schicht-Drehwiderstand LAYER-TYPE VAR RESISTOR 1kΩ +20/-30%; 0,1W	1 K lin Rel wd 165a
		Schichtwiderstand LAYER-TYPE RESISTOR	
R 136	1	6kΩ ±1%; 0,1W	B 51263 A 6 K 1/0,5
R 137	1	6kΩ ±5%; 0,5W	B 51265 A 6 K 5/2
	für Ausfg./FOR MODEL Rel 35 D 461a	1a	
R 139	1	50Ω ±1%; 0,1W	B 51263 A 50 Ω 1/0,5
	für Ausfg./FOR MODEL Rel 35 D 461a	1a,2a	
R 140,141	2	50Ω ±5%; 0,33W	B 51363 A 50 Ω 5/2
		Schalenkernspule POT-CORE COIL	
Ü 1	1	Wicklg. I (1,3) 35 Wdg HFL S 60x0,04 0,3Ω 30µH ±1% Wicklg. IIa,IIb(4,5)(5,6) 6 Wdg 2x0,15 CuL verdr.0,42Ω	Rel Bv 622 N 3516
Ü 4	1	Wicklg. I (1,3) 175 Wdg 0,20 CuL 1,7Ω Wicklg. IIa,IIb(4,5)(5,6) 18 Wdg 2x0,20 CuL verdr.0,5Ω 0,296mH ±1%	Rel Bv 622 N 3517
Ü 5	1	Wicklg. I (1,3) 302 Wdg 0,14 CuL 13,5Ω 10mH ±1% Wicklg. IIa,IIb(4,5)(5,6) 10 Wdg 2x0,14 CuL verdr.0,5Ω	Rel Bv 622 N 3513

		Schalenkernspule POT-CORE COIL	
Ü 6	1	Wicklg. I (1,2,3) 720 Wdg 0,08 CuL 135Ω Abgriff (2): 480 Wdg 320mH ±2% Wicklg. IIa,IIb(4,5)(5,6) 178 Wdg 2x0,08 CuL verdr.42Ω	Rel Bv 622 P 3297
Ü 7	1	Wicklg. I (4,6) 130 Wdg 0,10 CuL 14Ω Wicklg. II (1,2,3) 1575 Wdg 0,08 CuL 320Ω Abgriff (2): 394 Wdg 1530mH ±2%	Rel Bv 622 P 3298
Ü 8	1	Wicklg. I (4,5) 12 Wdg 0,40 CuL 0,07Ω Wicklg. II (1,2,6) 7 Wdg 0,40 CuL 0,055Ω Abgriff (2): 2 Wdg	Rel Bv 622 N 3439
Ü 9	1	Wicklg. I(3,rt)(rt,4) 96 Wdg 0,26 CuL 1Ω Abgriff (rt): 55 Wdg ab Abgriff FROM TAP: 0,35 CuL Wicklg. II (6,5,2,1) 31 Wdg 0,23 CuL 1.Abgriff (5): 5 1/2 Wdg 2.Abgriff (2): 11 Wdg	Rel Bv 622 N 3510
	1	Lötstiftleiste SOLDERING-PIN STRIP 12polig / 12-POLE	Rel ale 55am
D,E,F G,K	5	SG-Relais DRY-REED RELAY Wicklg. I (3,4) 6700 Wdg 0,07 CuL 880Ω	Rel Bv 662 E 31

		Kf-Kondensator PLASTIC-FOIL CAPACITOR	
C 45	1	9950pF ±1%; 125V-	B31142-A1992-F500
C 46	1	4755pF ±1%; 125V-	B31140-A1472-F550
C 47	1	9680pF ±1%; 125V-	B31142-A1962-F800
C 48	1	275pF ±1%; 125V-	B31140-A1271-F500
C 49	1	9075pF ±1%; 125V-	B31142-A1902-F750
C 50	1	605pF ±1%; 125V-	B31140-A1601-F500
C 51	1	9350pF ±1%; 125V-	B31142-A1932-F500
		Schalenkernspule POT-CORE COIL	
L 10	1	Wicklg. I (2,6,1,3) 1040 Wdg oder/OR 1050 Wdg } 0,11 CuL 110Ω oder/OR 1060 Wdg 1.Abgriff (6): 226 Wdg 2.Abgriff (1): 377 Wdg 679mH	Rel Bv 622 P 3300
L 11	1	Wicklg. I (1,3) 1060 Wdg 0,11 CuL 110Ω 1.Abgriff (3): 1040 Wdg oder/OR 2.Abgriff (3): 1050 Wdg 679mH	Rel Bv 622 P 3301
L 12	1	Wicklg. I (6,5,4) 1040 Wdg oder/OR 1050 Wdg } 0,11 CuL 110Ω oder/OR 1060 Wdg Abgriff (5): 377 Wdg 679mH	Rel Bv 622 P 3302
L 13	1	Wicklg. I (2,4) 1026 Wdg 0,11 CuL 100Ω 1.Abgriff (4): 1006 Wdg oder/OR 2.Abgriff (4):1016 Wdg 637mH	Rel Bv 622 P 3303

L 14	1	Schalenkernspule POT-CORE COIL Wicklg. I (2,1,6,5) 1015 Wdg 0,11 CuL 105Ω 1.Abgriff (1): 101 Wdg 2.Abgriff (6): 137 Wdg	Rel Bv 622 P 3304
R 42	1	Schichtwiderstand LAYER-TYPE RESISTOR ...kΩ ±1%; 0,1W Wert wie eingebaut VALUE AS MOUNTED	B 51263 A ... K 1/0,5

1,62-MHz-Tiefpaß Rel 35 D 542a (Ausgabe II)
1.62-MC/S LOW-PASS FILTER (ISSUE II)

		Kf-Kondensator PLASTIC-FOIL CAPACITOR	
C 1,9	2	78pF ±1%; 125V-	B31140-A1780-F
C 2	1	80pF ±1%; 125V-	B31140-A1800-F
C 3	1	58pF ±1%; 125V-	B31140-A1580-F
C 4	1	110pF ±1%; 125V-	B31140-A1111-F
C 5	1	135pF ±1%; 125V-	B31140-A1131-F500
C 6	1	14pF ±1%; 125V-	B31140-A1140-F
C 8	1	105pF ±1%; 125V-	B31140-A1101-F500
C 10	1	1000pF ±10%; 125V-	B31140-A1102-K
C 11	1	MKL-Kondensator MKL CAPACITOR 0,1µF ±20%; 100V-	B32110-C0104-M
		Schalenkernspule POT-CORE COIL	
L 1,5	2	Wicklg. I (3,4) 32 Wdg HFL S 60x0,04 0,34Ω	Rel Bv 622 N 3522
L 2	1	Wicklg. I (3,4) 41 Wdg HFL S 60x0,04 0,4Ω	Rel Bv 622 N 3523
L 3	1	Wicklg. I (3,2,4) 58 Wdg HFL S 45x0,04 0,8Ω Abgriff (2): 29 Wdg	Rel Bv 622 N 3524
L 4	1	Wicklg. I (3,4) 53 Wdg HFL S 45x0,04 0,7Ω	Rel Bv 622 N 3525
Md 1	1	Steckmodulator "R" PLUG-IN MODULATOR "R" 4x0A90	Rel Bv 672 R 165
		Schichtwiderstand LAYER-TYPE RESISTOR	
R 1	1	700Ω ±1%; 0,1W	B 51263 A 700 Ω 1/0,5
R 2	1	12kΩ ±5%; 0,2W	B 51362 A 12 K 5/2
R 3	1	...kΩ ±5%; 0,25W Wert wie eingebaut VALUE AS MOUNTED	B 51263 A ... K 5/2
R 4	1	200Ω ±5%; 0,2W	B 51362 A 200 Ω 5/2
R 5	1	60Ω ±5%; 0,2W	B 51362 A 60 Ω 5/2
R 6	1	1kΩ ±1%; 0,1W	B 51263 A 1 K 1/0,5
R 11,13	2	1,9kΩ ±1%; 0,1W	B 51263 A 1,9 K 1/0,5
R 14,15	2	2kΩ ±1%; 0,1W	B 51263 A 2 K 1/0,5

R	12	1	Schicht-Drehwiderstand LAYER-TYPE VAR RESISTOR 200Ω +20/-30%; 0,1W	200 Ω lin Rel wd 165a
			Schalenkernspule POT-CORE COIL	
Ü	1	1	Wicklg. I (1,3) 4 Wdg 0,15 CuL 0,18Ω Wicklg. IIa,IIb(4,5)(5,6) 8 Wdg 2x0,15 CuL verdr.0,75Ω	Rel Bv 622 N 3515
Ü	2	1	Wicklg. Ia,Ib(4,5)(5,6) 11 Wdg 2x0,15 CuL verdr.0,45Ω Wicklg. II (1,3) 44 Wdg 0,15 CuL 1,9Ω	Rel Bv 622 N 3433

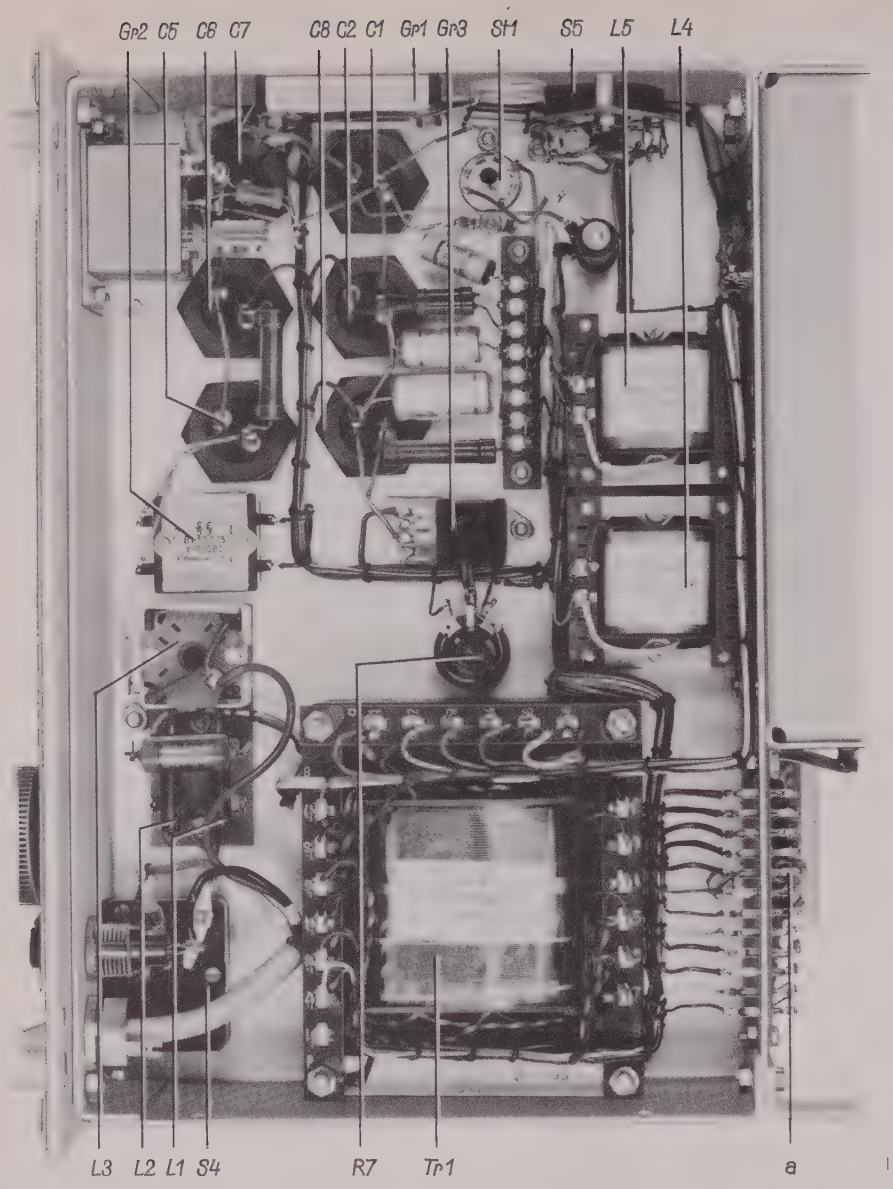


Bild 6 Netzteil Rel 35 D 463a
FIG. 6 POWER SUPPLY UNIT

Netzteil Rel 35 D 463a (Ausgabe II)
POWER SUPPLY UNIT (ISSUE II)

C 1,2	2	Elektrolyt-Kondensator ELECTROLYTIC CAPACITOR 50µF +50/-10%; 250V-	B43691-A2506-T
C 3	1	MKH-Kondensator MKH CAPACITOR 0,1µF ±20%; 300V-	B32220-A3104-M
		Elektrolyt-Kondensator ELECTROLYTIC CAPACITOR	
C 4	1	25µF +50/-20%; 35V-	B41931-A7256-S
C 5-7	3	32µF +50/-10%; 350V-	B43691-A4326-T
C 8	1	250µF +50/-20%; 35V-	B41711-A7257-S
C 9	1	50µF +50/-20%; 35V-	B41931-A7506-S
C 10	1	MKH-Kondensator MKH CAPACITOR 0,025µF ±20%; 1kV-	B32222-J0253-M
		Flachgleichrichter FLAT-TYPE RECTIFIER	
Gr 1	1	250V / 125mA	V23201-F1168
Gr 2	1	250V / 75mA	V23201-F1080
Gr 3	1	30V / 250mA	V23201-F1208
L 1,2	2	UKW-Drossel VHF REACTOR 30µH; 1,5A; 340mΩ	B82501-A-A35
L 3	1	Schalenkernspule POT-CORE COIL Wicklg. Ia/Ib(ge,4)(ge,4) 10 Wdg 0,80 CuL 22/25mΩ	Rel Bv 622 P 3306
L 4,5	2	Siebdrossel FILTER CHOKE Wicklg. I (2a,3a) 3620 Wdg 0,17 CuL 280Ω 5,5H	Rel Bv 621 E 3256
R 1	1	Drahtwiderstand WIRE-WOUND RESISTOR 5kΩ ±5%; 4W	B52365-A2502-J
		Schichtwiderstand LAYER-TYPE RESISTOR	
R 2	1	470kΩ ±5%; 0,33W	B 51264 A 470 K 5/2
R 3	1	200kΩ ±5%; 0,33W	B 51264 A 200 K 5/2
R 4	1	25kΩ ±5%; 0,33W	B 51264 A 25 K 5/2

R 5	1	Schichtwiderstand LAYER-TYPE RESISTOR 300Ω ±5%; 1W	B 51266 A 300 Ω 5/2
R 7	1	Draht-Drehwiderstand WIRE-WOUND VAR RESISTOR 100Ω ±10%; 0,5W	100 Ω Ms sdr 70c
		Schichtwiderstand LAYER-TYPE RESISTOR	
R 8	1	40Ω ±5%; 1W	B 51266 A 40 Ω 5/2
R 10	1	2,5kΩ ±1%; 0,1W	B 51263 A 2,5 K 1/0,5
R 11	1	27,5kΩ ±1%; 0,1W	B 51263 A 27,5 K 1/0,5
S 4	1	Netzschalter POWER SWITCH 250V / 6A	Rel sch 171a
S 5	1	Spannungswähler VOLTAGE ADJUSTER	Rel sch 268a
Tr 1	1	Netztransformator POWER TRANSFORMER	Rel Bv 621 K 3065
		Wicklg. I (1a,2a,3a) 76 Wdg 0,50 CuL 1Ω Abgriff (2a): 38 Wdg	
		Wicklg. II/III(3a,5a)(4a,6a) 420 Wdg 0,38 CuL 10/11Ω	
		Wicklg. IV (4b,3b) 710 Wdg 0,27 CuL 40Ω	
		Wicklg. V (5d,4d) 820 Wdg 0,18 CuL 110Ω	
		Wicklg. VI (2b,7b) 26 Wdg 2x0,80 CuL paral.0,1Ω	
		Wicklg. VII (7d,6d) 26 Wdg 0,60 CuL 0,35Ω	
		Wicklg. VIII (5b,6b) 84 Wdg 0,26 CuL 6Ω	
		Wicklg. IX (2d,3d) 21 Wdg 0,40 CuL 0,6Ω	
	1	Buchsenplatte JACK PANEL	Rel Bv 654 B 58
	1	Lötösenleiste SOLDERING-LUG STRIP	Rel ale 87c
	1	Lötstiftleiste SOLDERING-PIN STRIP 12polig / 12-POLE	Rel ale 55bm

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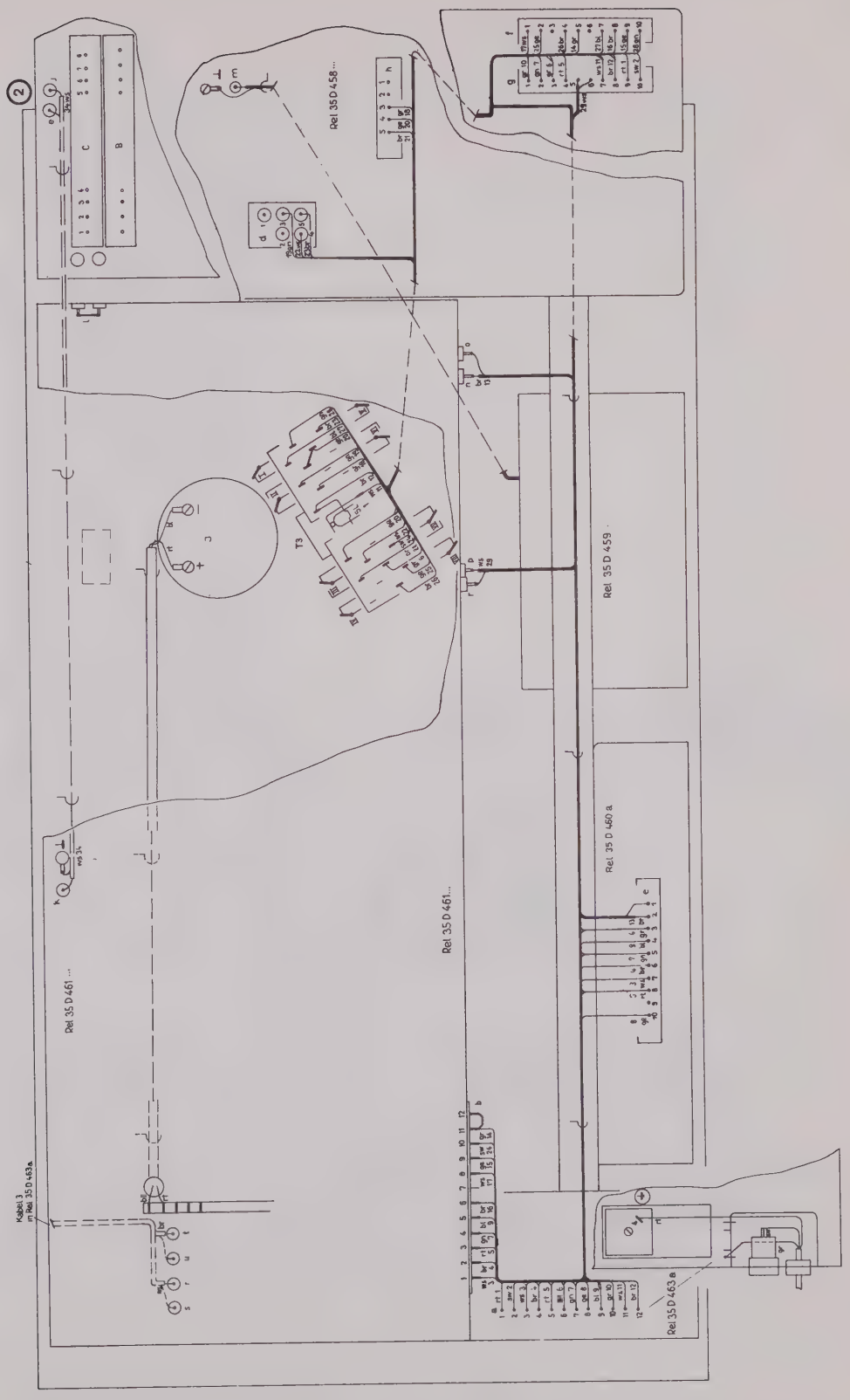

Pegelmesser 0,2-1600 kHz
LEVEL METER 0.2-1600 KC/S

Rel ms 3 D 344a Dt/En

Ausg. II 25.2.65 Brehmer

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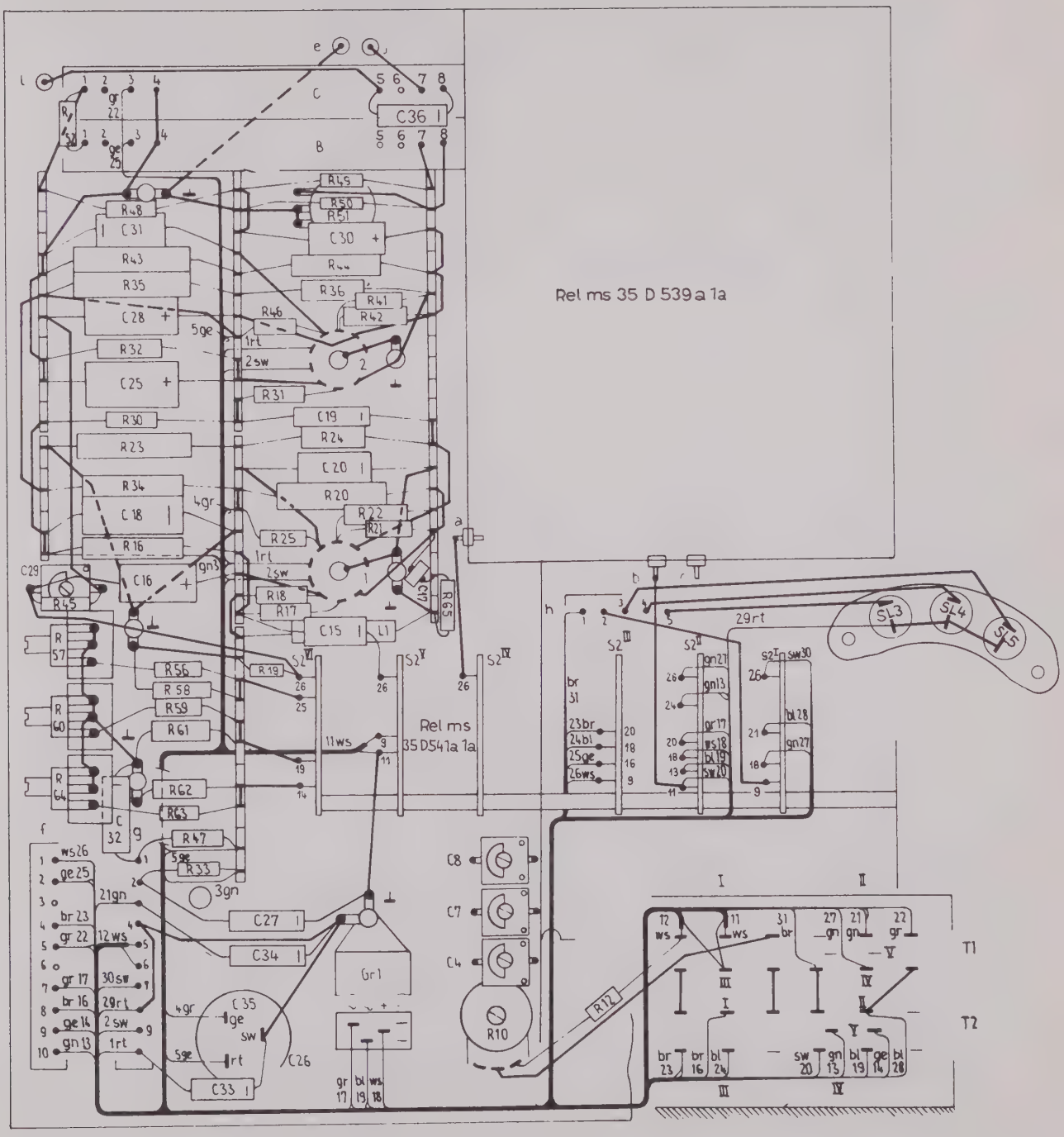

Meßfeld und Vorverstärker
MEASURING FIELD AND PREAMPLIFIER

Rel ms 35 D 458a1a Dt/En

Ausg.III 25.2.65 Brehmer

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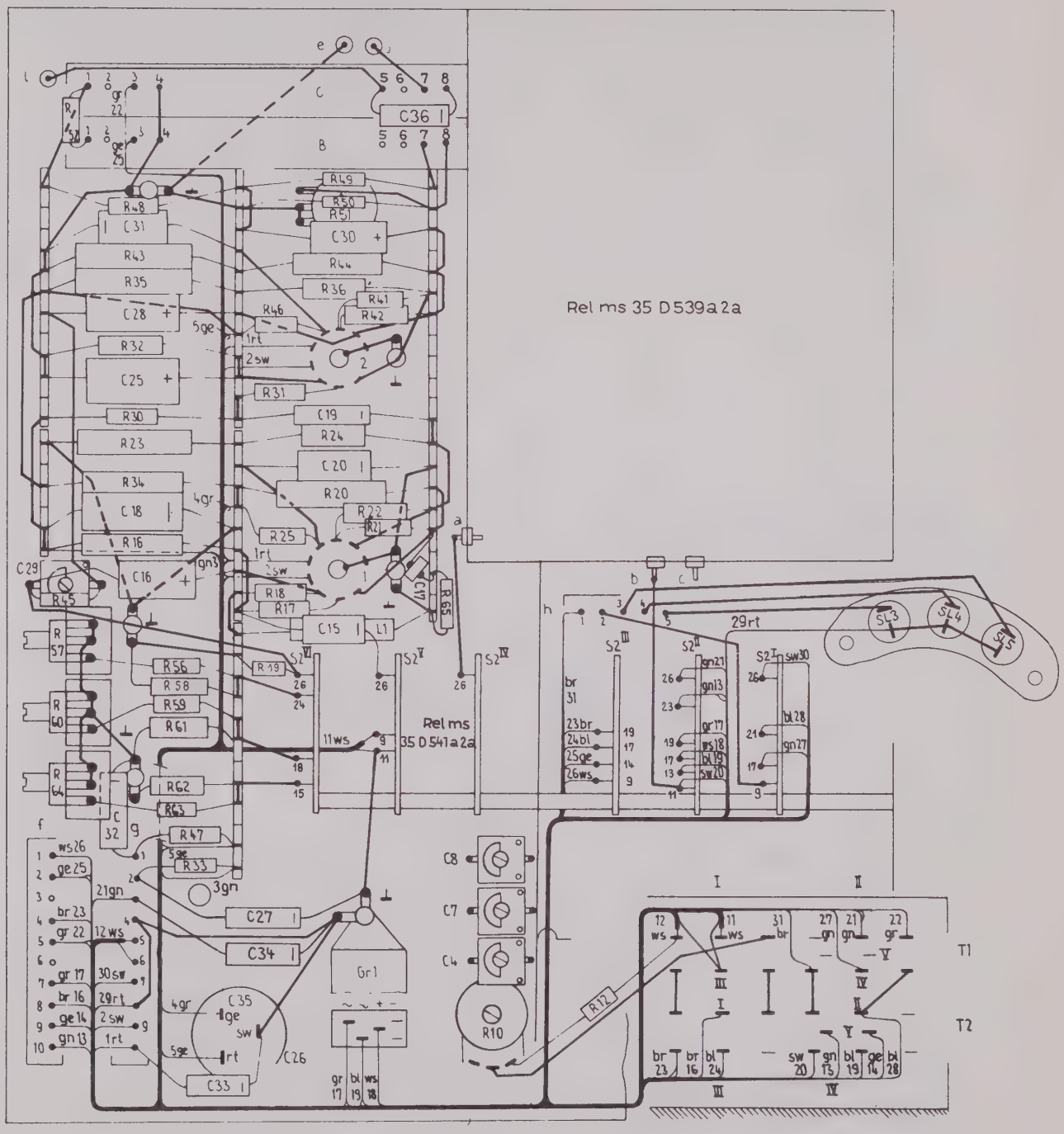

Meßfeld und Vorverstärker
MEASURING FIELD AND PREAMPLIFIER

Rel ms 35 D 458a2a Dt/En

Ausg.III 25.2.65 Brehmer

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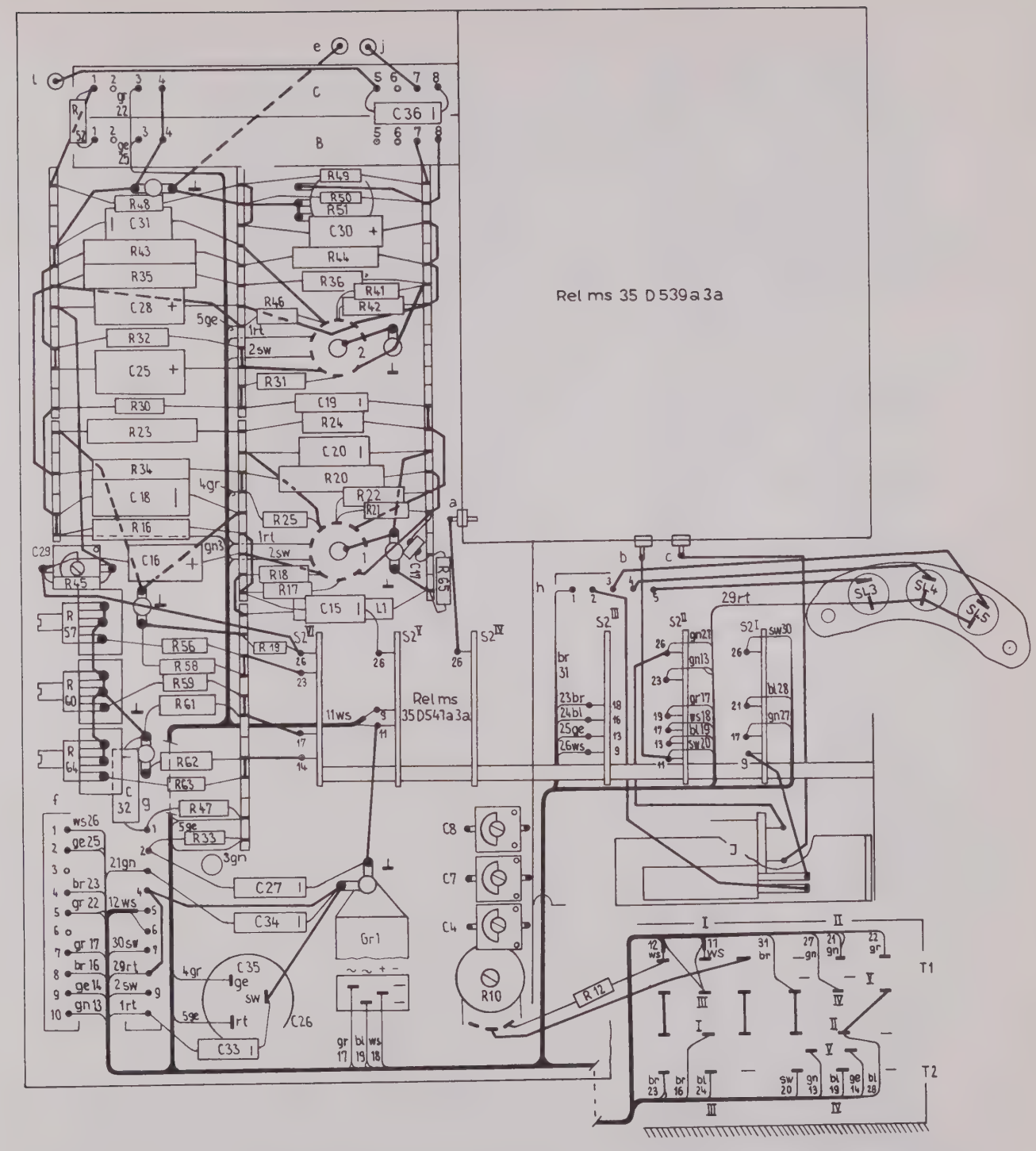

Meßfeld und Vorverstärker
MEASURING FIELD AND PREAMPLIFIER

Rel ms 35 D 458a3a Dt/En

Ausg. III 25.2.65 Brehmer

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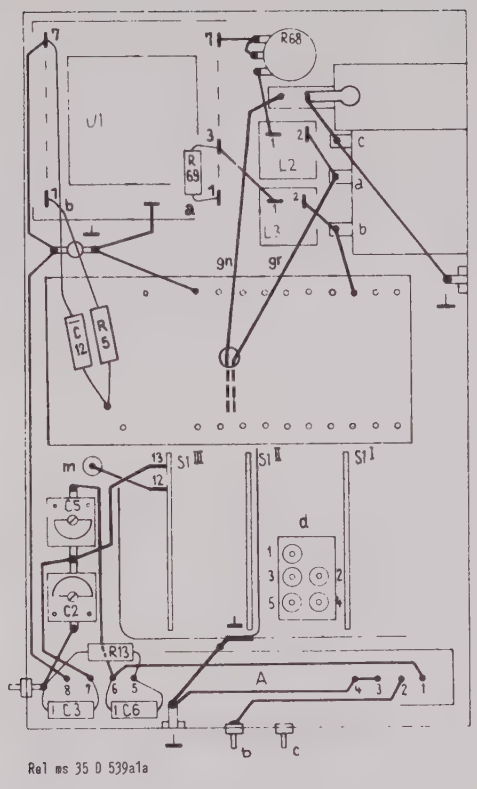
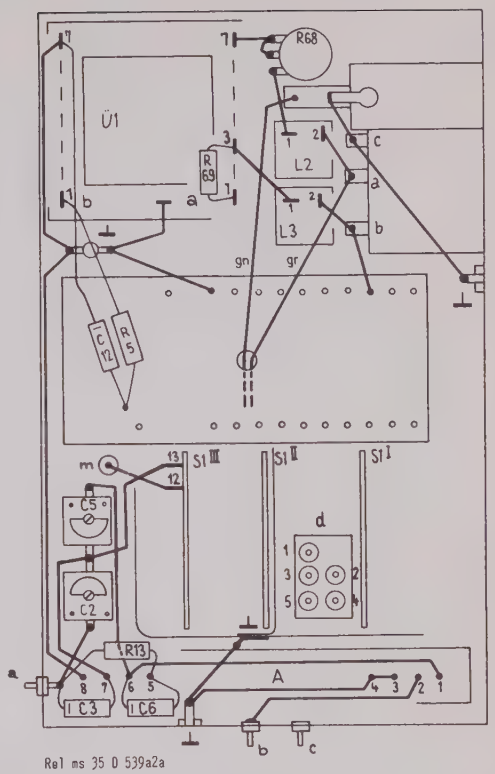


Rel ms 35 D 539a1a



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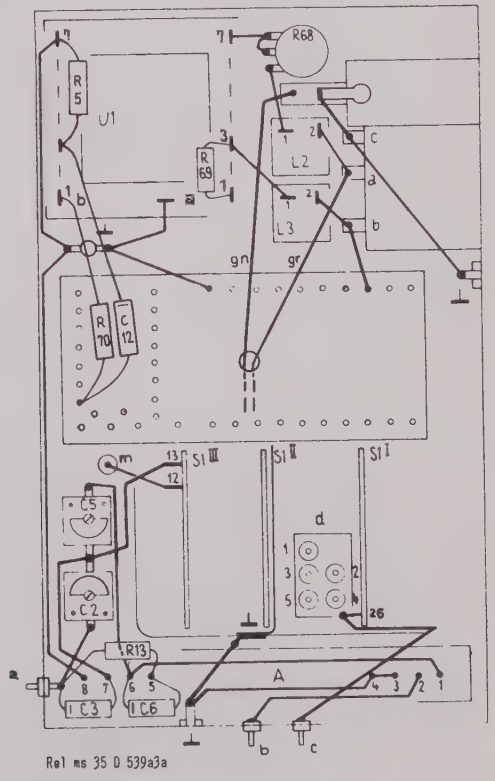

Rel ms 35 D 539a3a

Eingangsbaugruppe
INPUT SUBASSEMBLY (DBM)

Rel ms 35 D 539a1a,2a,3a Dt/En

Ausg.4 3.3.66 Br

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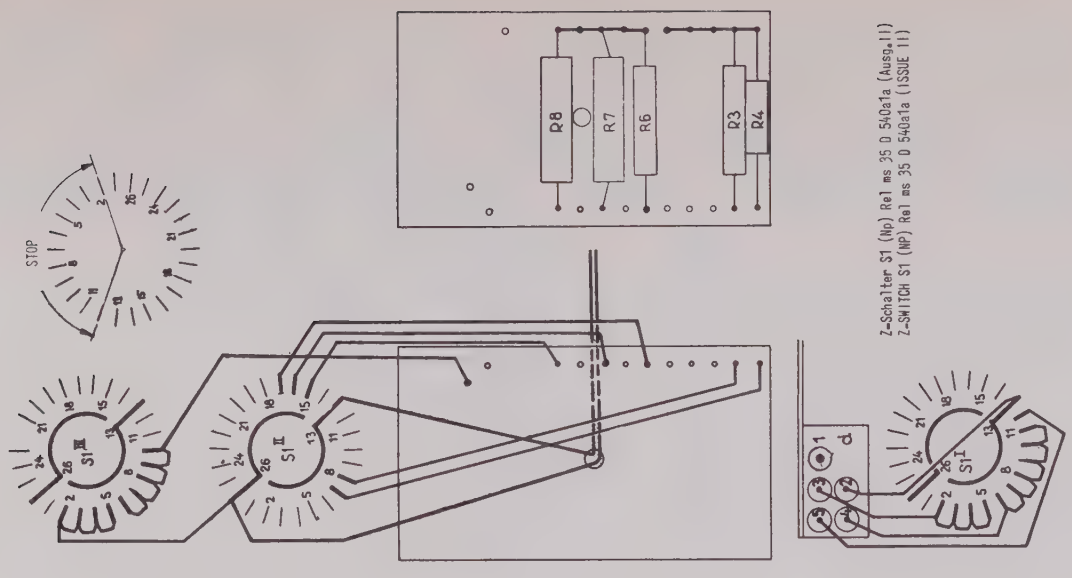

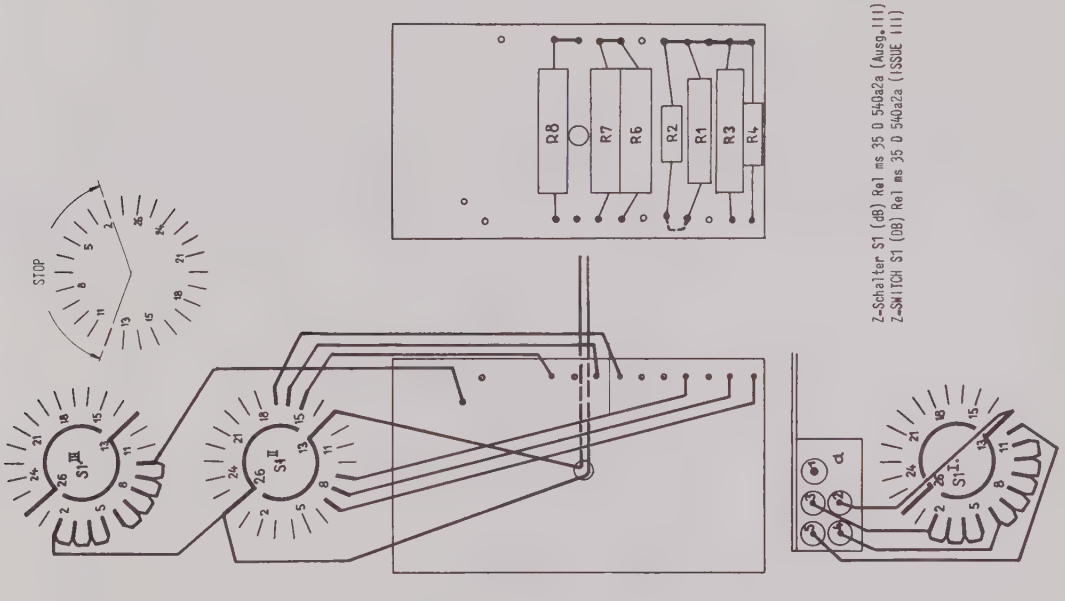

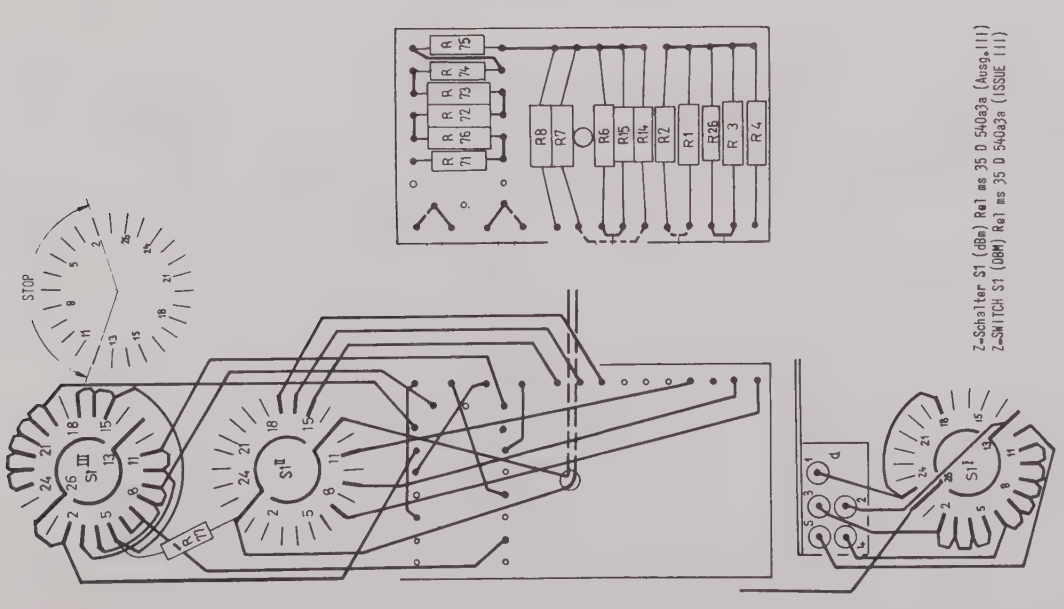

Z-Schalter S1 (Np; dB; dBm) Rel ms 35 D 540a1a,2a,3a Dt/En
Z-SWITCH S1 (NP; DB; DBM)

Ausg.II/III/III Br

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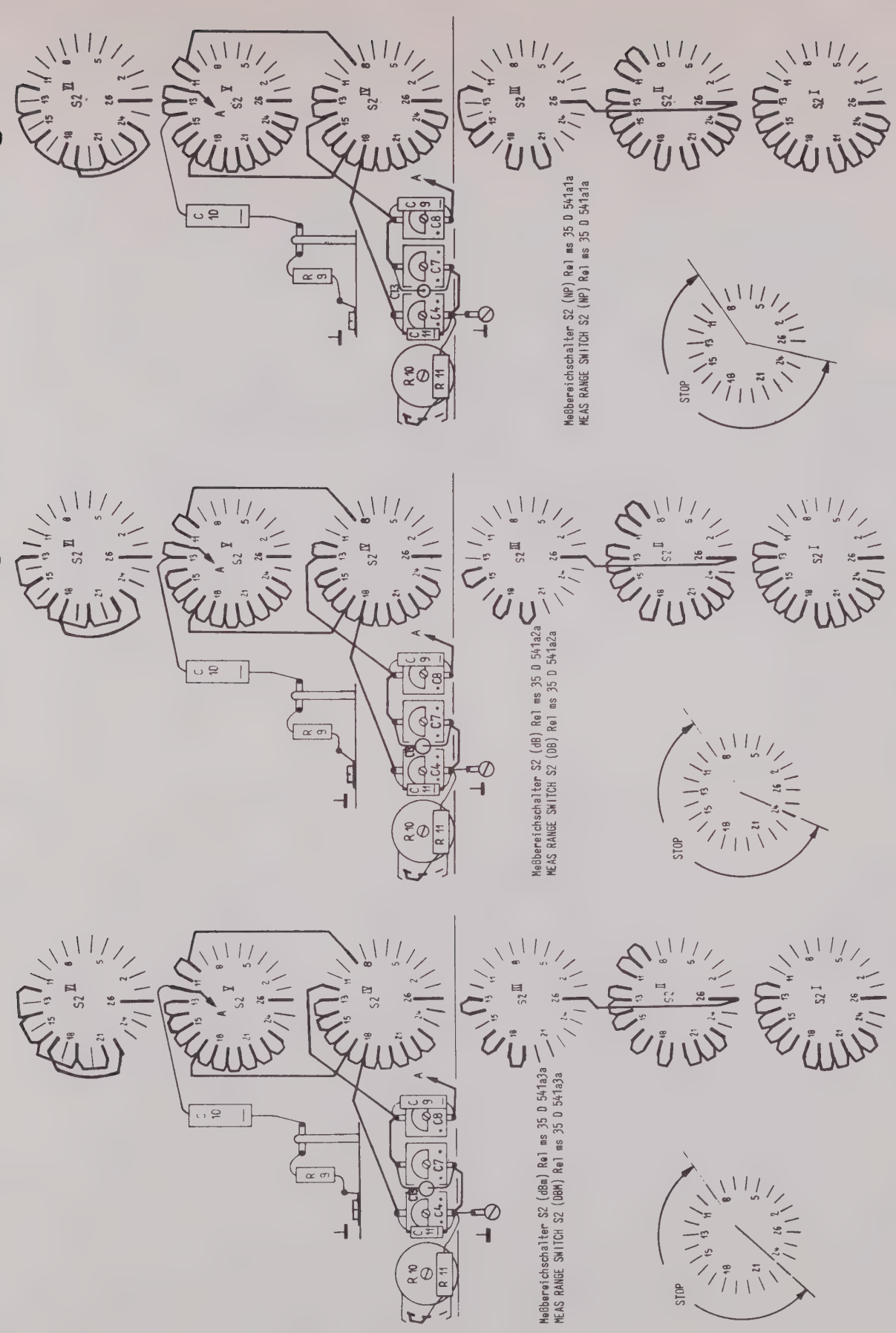

Meßbereichschalter S2 (Np;dB; dBm) Rel ms 35 D 541a1a,2a,3a Dt/En
MEAS RANGE SWITCH S2 (NP;DB;DBM)

Ausg.II 22.9.64 Br

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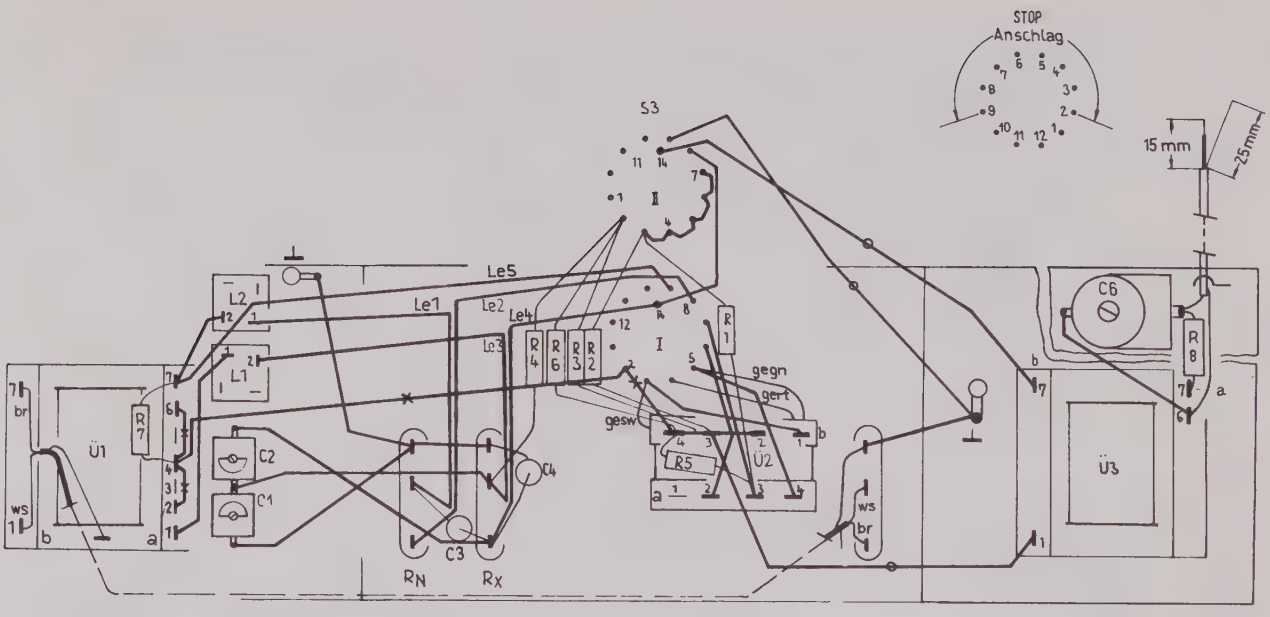
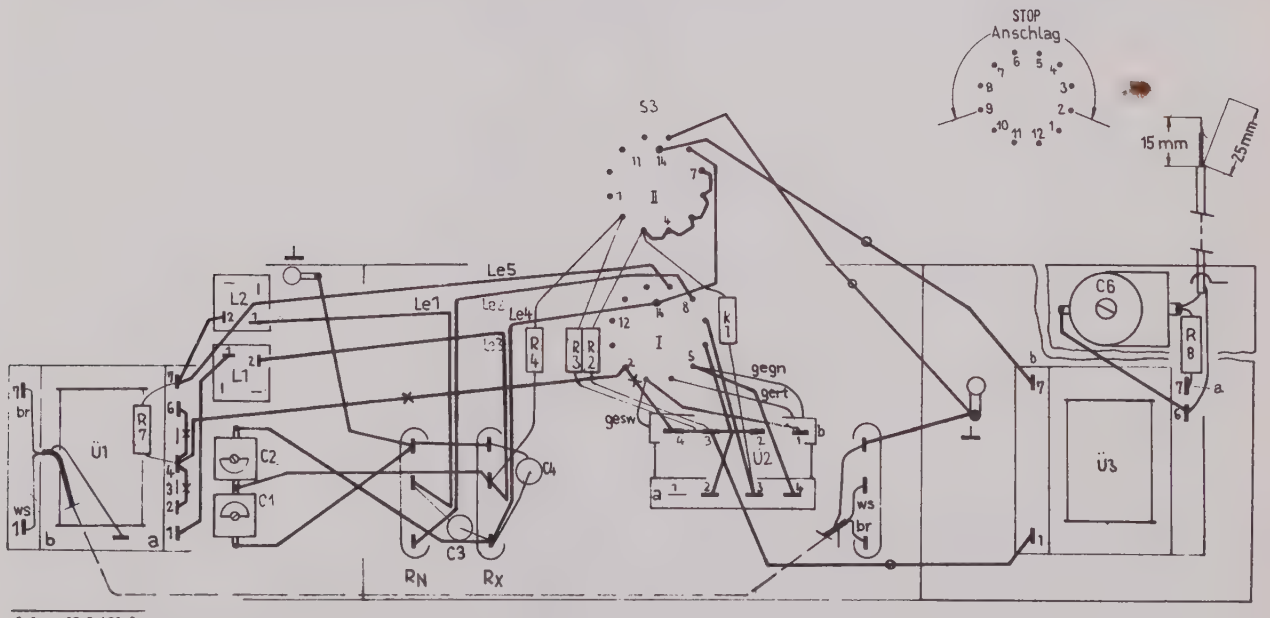


Rel ms 35 D 459a1a



Rel ms 35 D 459a2a

Meßzusatz
MEAS ATTACHMENT

Rel ms 35 D 459a1a,2a Dt/En

Ausg.6 3.3.66 Br

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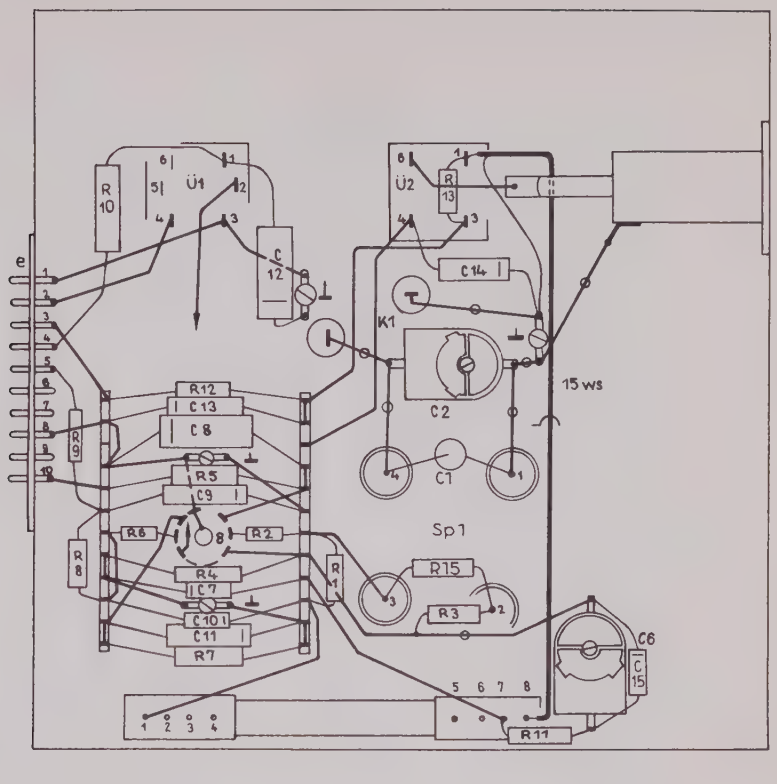

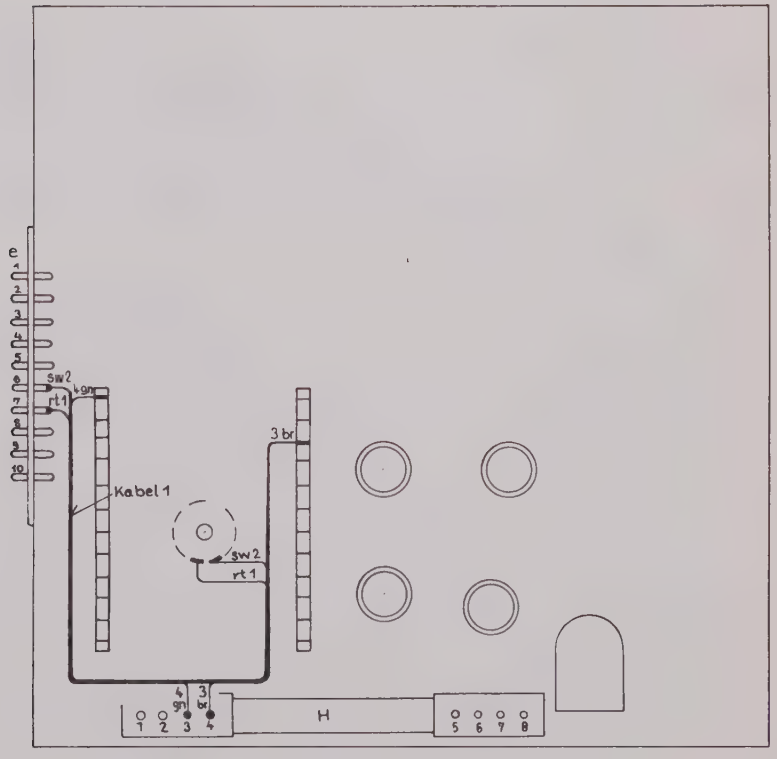

Oszillator 1
OSCILLATOR 1

Rel ms 35 D 460a Dt/En

Ausg. III 25.2.65 Brehmer

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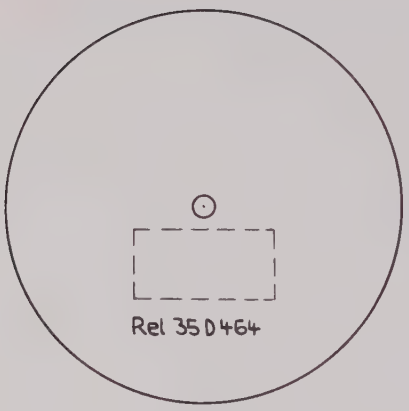

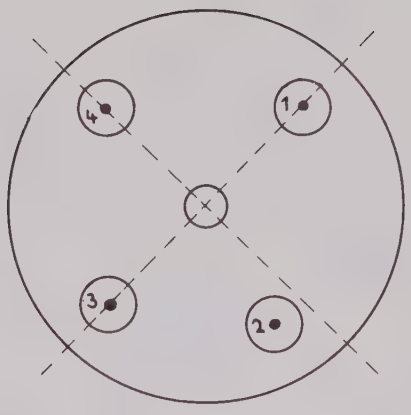

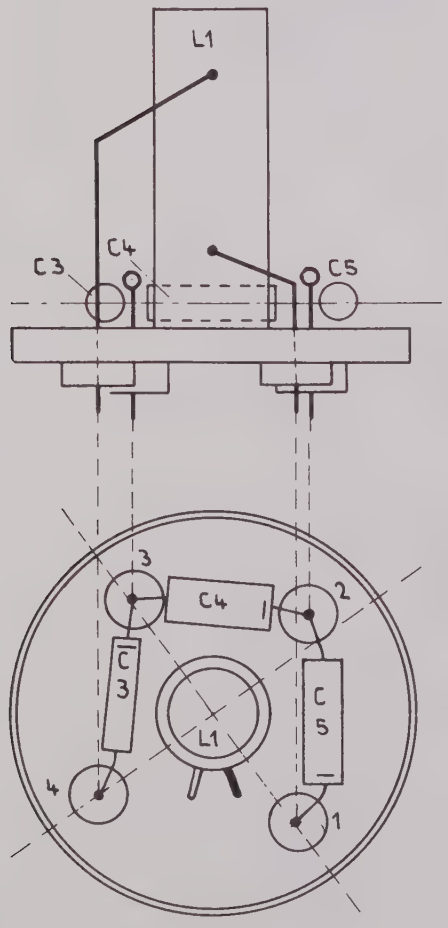

Spulentopf 1
COIL CAN 1

Rel ms 35 D 464a Dt/En

Ausg. I 15.5.64 Brehmer

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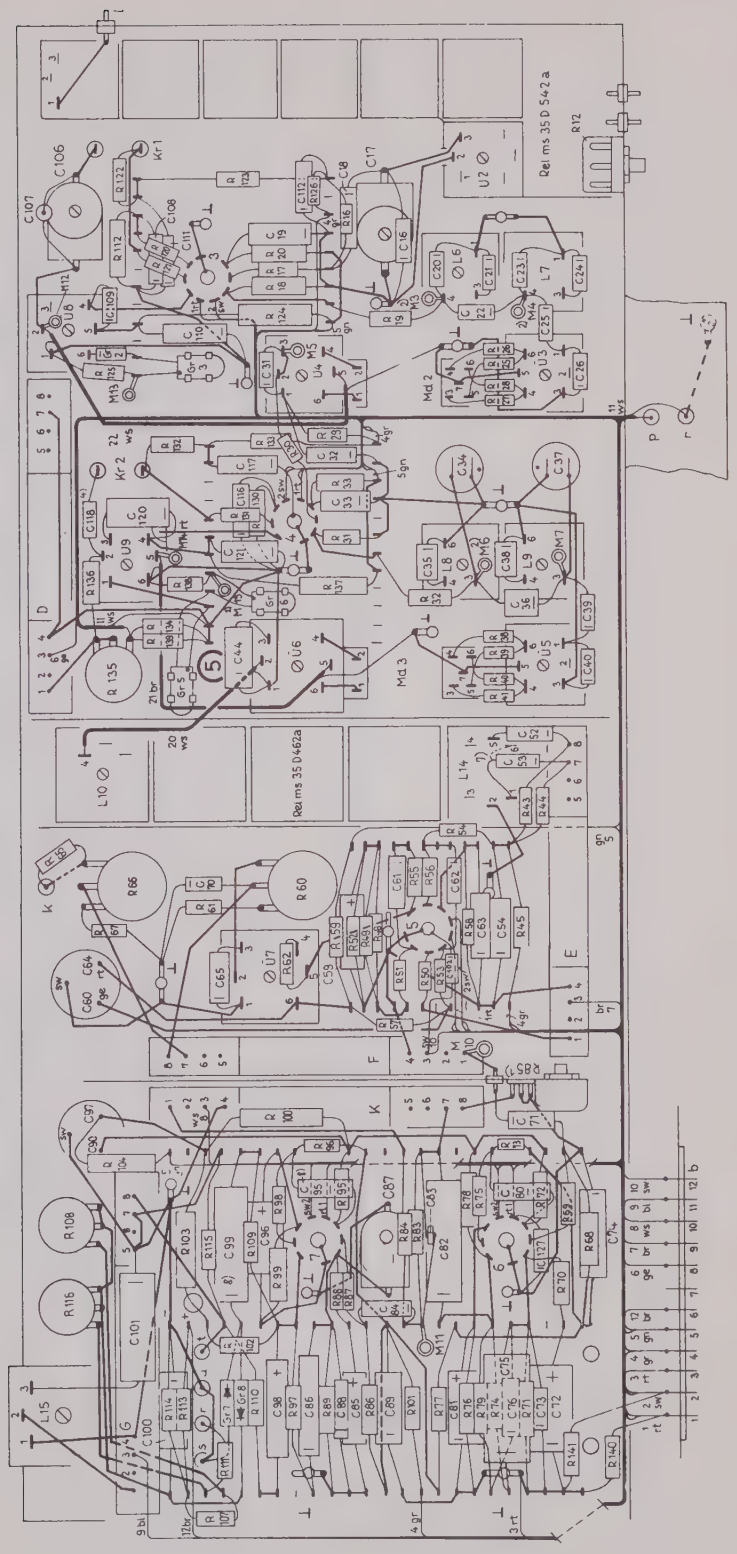

Verstärker und Umsetzer
AMPLIFIER AND CONVERTER

Rel ms 35 D 461a Dt/En

Ausg. V 3.3.66 Brehmer

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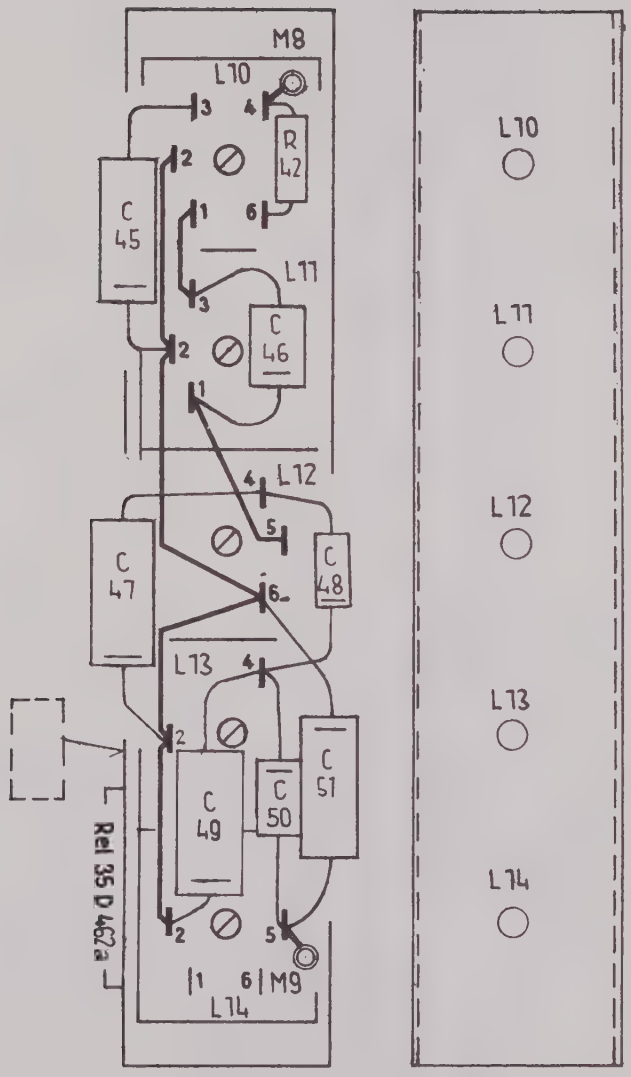

2-kHz-Filter
2-KC/S FILTER

Rel ms 35 D 462a Dt/En

Ausg. I 15.5.64 Brehmer

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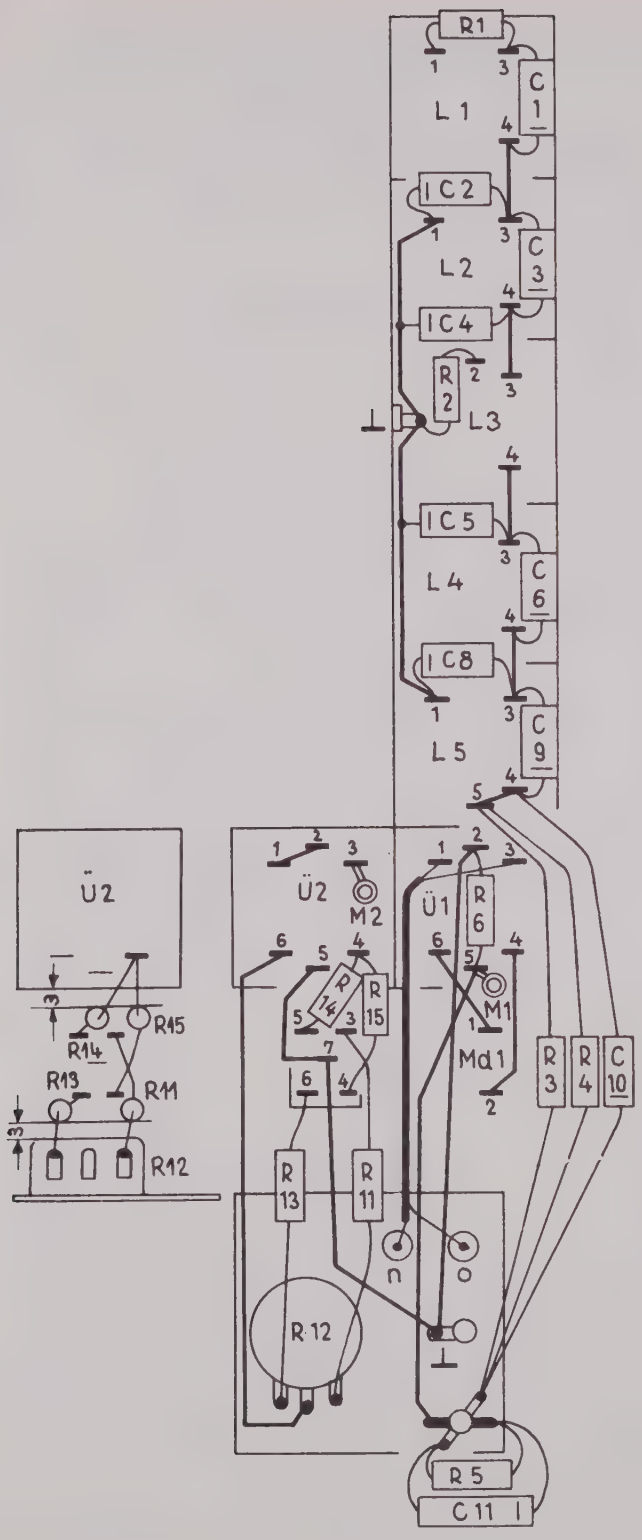

1,62-MHz-Tiefpaß
1.62 MC/S LOW-PASS FILTER

Rel ms 35 D 542a Dt/En

Ausg.III 4.12.65 Brehmer

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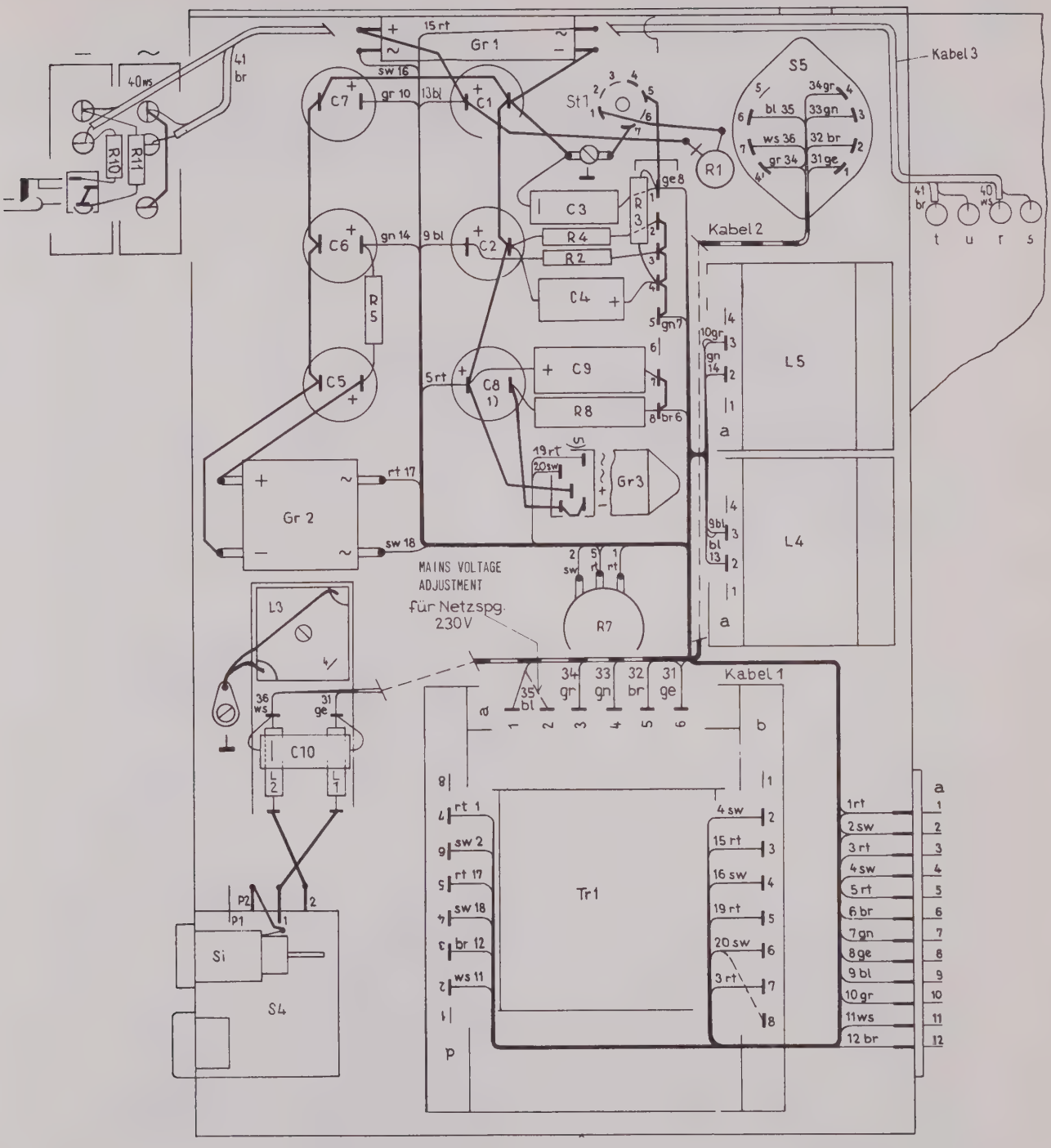

Netzteil
POWER SUPPLY UNIT

Rel ms 35 D 463a Dt/En

Ausg. IV 4.12.65 Brehmer

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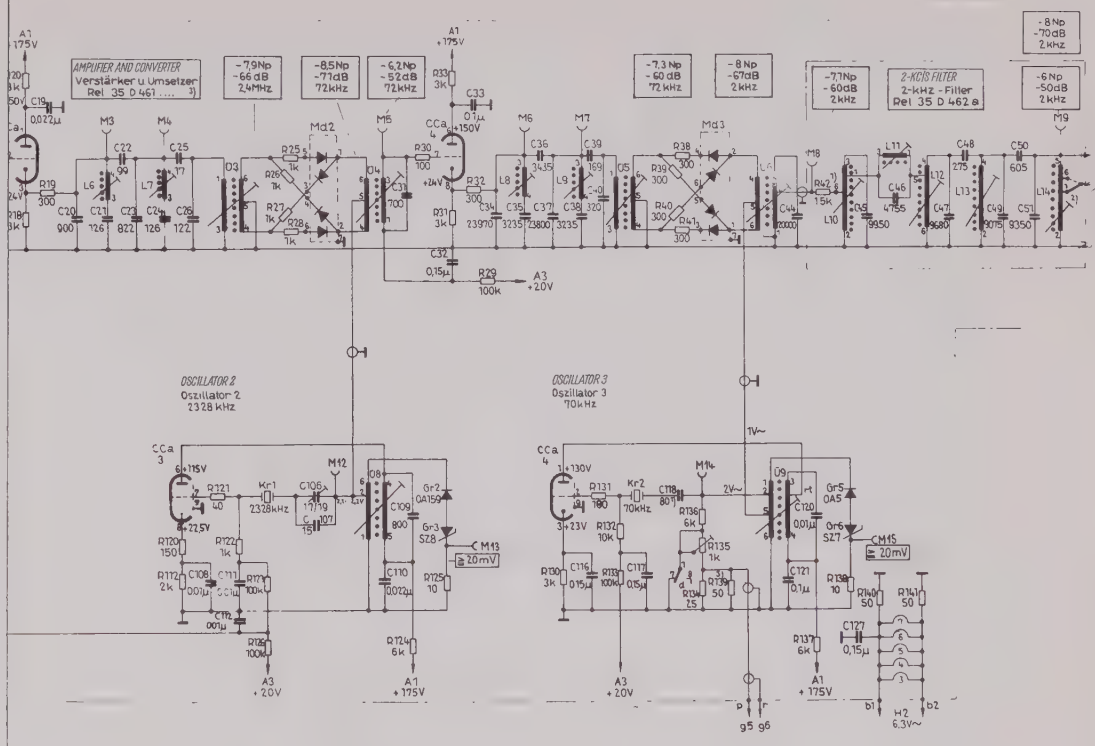

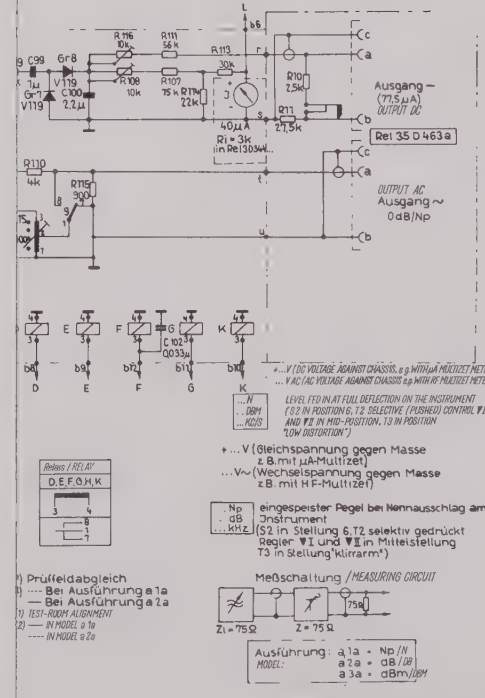
Ausgang — (77,5 µA) OUTPUT DC
Rel 35 D 463 a
OUTPUT AC
Ausgang ~
0dB/Np
+...V (Gleichspannung gegen Masse z.B. mit µA-Multizet)
...V~ (Wechselspannung gegen Masse z.B. mit HF-Multizet)
...Np ...dB ...kHz eingespeister Pegel bei Nennausschlag am Instrument (S2 in Stellung 6, T2 selektiv gedrückt Regler ▼I und ▼II in Mittelstellung T3 in Stellung 'klirrarm')
Meßschaltung / MEASURING CIRCUIT
Zi = 75Ω
Z = 75Ω
Ausführung: a1a = Np/N
MODEL: a2a = dB/dB
a3a = dBm/dBM

Pegelmesser 0,2 ... 1600 kHz Rel str 3 D 344a1a,2a,3a D+/En
LEVEL METER 0.2 TO 1600 KC/S

2,65 Br

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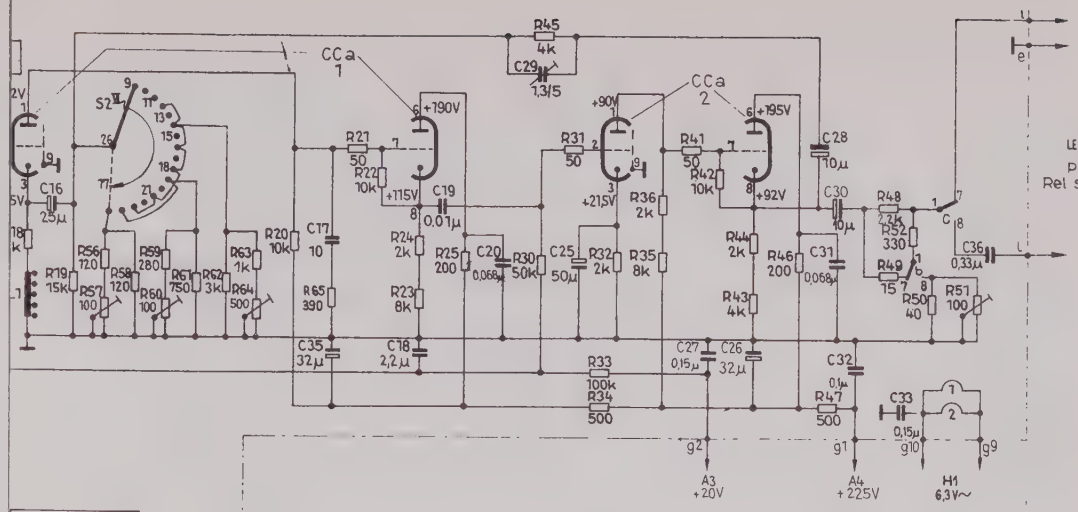
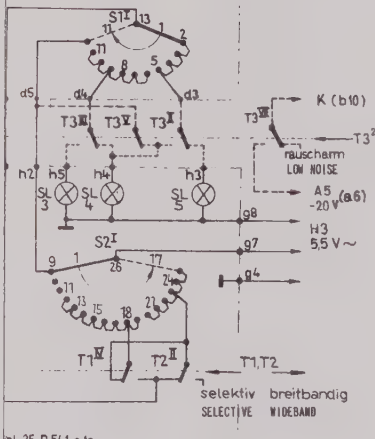


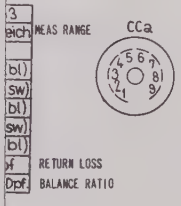


MEASURING FIELD AND PREAMPLIFIER WITH MEAS RANGE SWITCH S2
INPUT SUBASSEMBLY
Z-SWITCH S1
MEASURING ATTACHMENT

Rel str 35 D 458 a 1a enthält: / CONTAINS:

a) Meßfeld und Vorverstärker	Rel 35 D 458 a 1a
mit Meßbereichschalter S2	Rel 35 D 541 a 1a
Eingangsbaugruppe	Rel 35 D 539 a 1a
Z-Schalter S1	Rel 35 D 540 a 1a
b) Meßzusatz	Rel 35 D 459 a 1a

Rel 35 D 541 a 1a



1) Prüffeldabgleich / TEST ROOM ALIGNMENT
2) in Rel str 3 D 344a 1a,2a,3a enthalten
CONTAINED IN Rel str 3 D 344a1a,2a,3a

Meßfeld und Vorverstärker (Np) Rel str 35 D 458a1a Dt/En
MEASURING FIELD AND PREAMPLIFIER (NP)

6 3.3.66 Br

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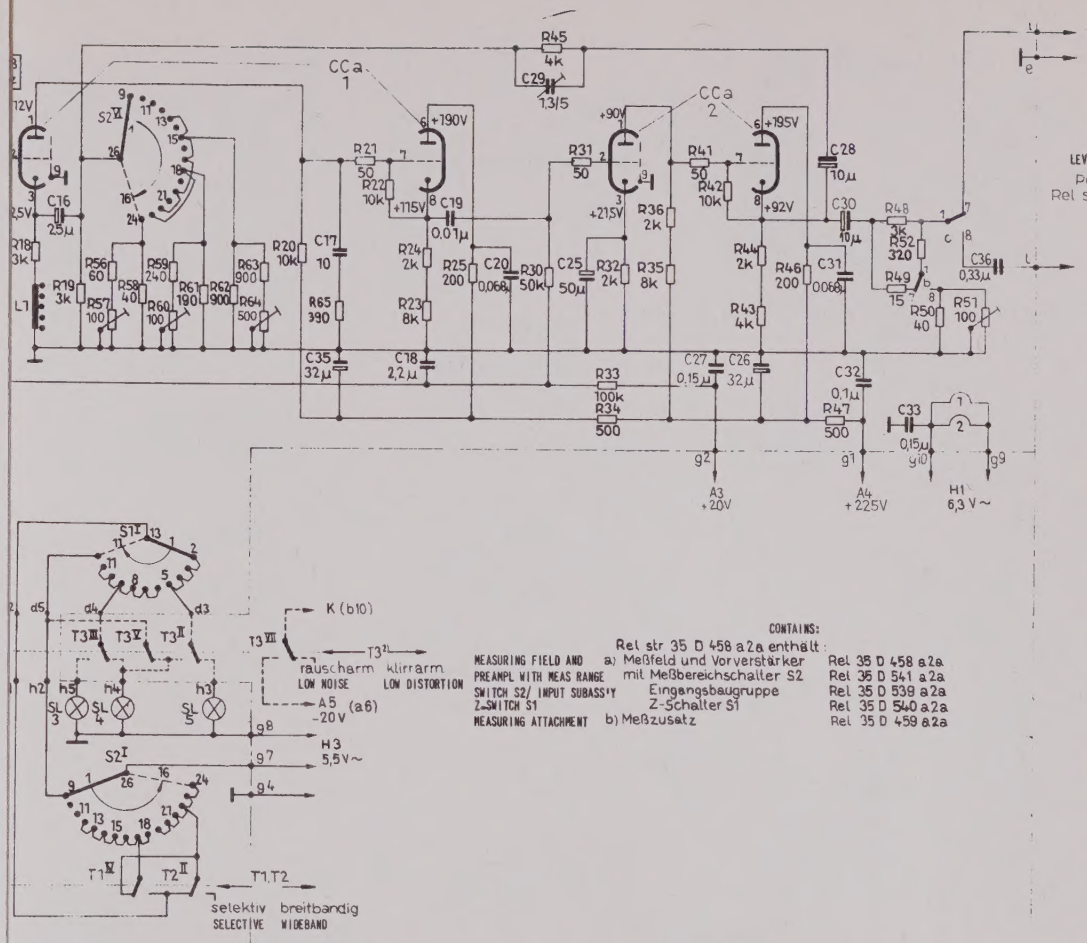
SIEMENS & HALSKE Aktiengesellschaft

SIEMENS



CONTAINS:

Rel str 35 D 458 a 2a enthält:

MEASURING FIELD AND PREAMPL WITH MEAS RANGE SWITCH S2/ INPUT SUBASS'Y Z-SWITCH S1	a) Meßfeld und Vorverstärker mit Meßbereichschalter S2 Eingangsbaugruppe Z-Schalter S1	Rel 35 D 458 a2a Rel 35 D 541 a 2a Rel 35 D 539 a 2a Rel 35 D 540 a 2a
MEASURING ATTACHMENT	b) Meßzusatz	Rel 35 D 459 a 2a

CCa

EAS RANGE

ETURN LOSS
ALANCE RATIO

1) Prüffeldabgleich / TEST ROOM ALIGNMENT
2) in Rel str 3 D 344a 1a,2a,3a enthalten / CONTAINED
3) Brücke X für Z = 135 Ω
LINK X FOR Z = 135 Ω

Meßfeld und Vorverstärker (dB)
MEASURING FIELD AND PREAMPLIFIER (DB)

Rel str 35 D 458a2a Dt/En

sg. 6 3.3.66 Br

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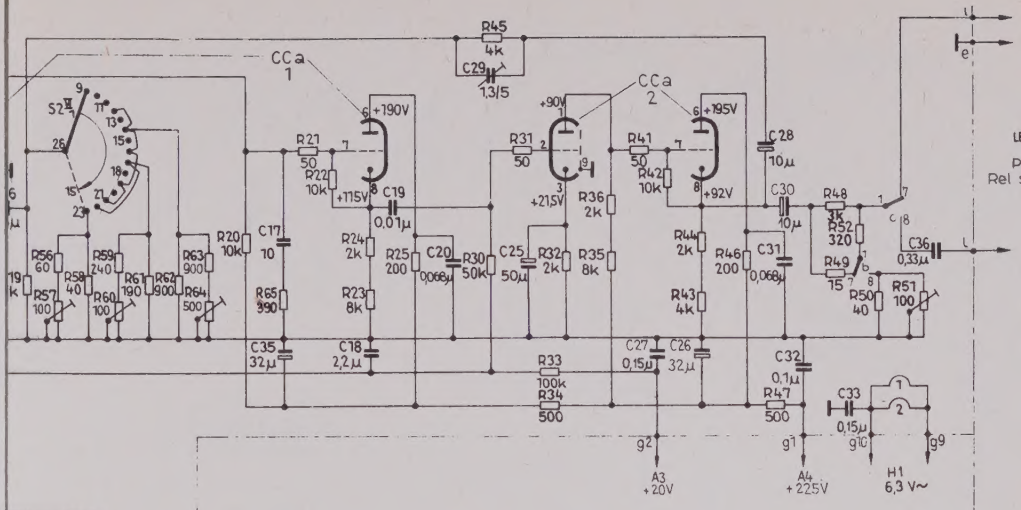

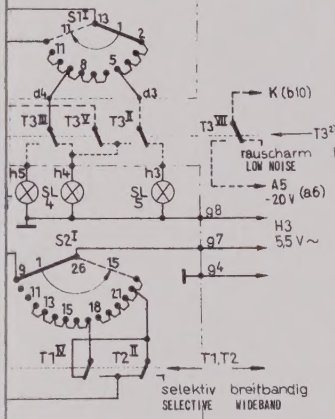

MEAS FIELD AND PREAMPLIFIER WITH MEAS RANGE SWITCH S2 INPUT SUBASSEMBLY Z-SWITCH S1 MEASURING ATTACHMENT

Rel str 458 a3a enthält: / CONTAINS:

a) Meßfeld und Vorverstärker mit Meßbereichschalter S2	Rel 35 D 458 a3a
	Rel 35 D 541 a3a
Eingangsbaugruppe	Rel 35 D 539 a3a
Z-Schalter S1	Rel 35 D 540 a3a
b) Meßzusatz	Rel 35 D 459 a2a

35 D 541 a3a

SWITCH S3

POSITION	Schalter S3 Stellg.	Meßbereich	MEAS RANGE
	1	▼	
	2	X1 (bl)	
	3	X1 (sw)	
	4	X10 (bl)	
	5	X10 (sw)	
	6	X100 (bl)	
	7	Refl-Dpf	RETURN LOSS
	8	Unsym-Dpf	BALANCE RATIO

CCa

1) Prüffeldabgleich / TEST ROOM ALIGNMENT
2) in Rel str 3 D 344a 1a,2a,3a enthalten / CONTAINED

← T1 breitbandig WIDEBAND

← T2 aktiv gedrückt ACTIVE (PUSHED)

Sender OSC

Meßfeld und Vorverstärker (dBm) Rel str 35 D 458a3a Dt/En
MEASURING FIELD AND PREAMPLIFIER (DBM)

g. 6 3.3.66 Br

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